Progress Report 172

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Oil and Gas Developments in Pennsylvania in 1965

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OIL AND GAS DEVELOPMENTS IN PENNSYLVANIA IN 1965

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ABSTRACT

Exploratory drilling in Pennsylvania in 1965 resulted in the discovery of three new deeper gas pools, one new gas pool and one new gas field. Development drilling extended several oil and gas fields and pools. Development drilling continued in the Youngsville-Sugar Grove Oil Field of Warren County as it did in the previous two years. There were 138 oil wells drilled in the field during 1965. Production for the field remained at about 1600 barrels of crude oil per day. Other shallow areas saw considerable development drilling. These areas were the southeast section of the Corry quadrangle, Warren quadrangle; Warren area; Tionesta-Pleasantville area and Big Run area in Clearfield, Indiana, and Jefferson Counties.

Operators continued to develop the Medina (Lower Silurian) in Erie and Crawword Counties. The Bushnell-Lexington Pool in Erie County had 46 gas wells drilled within its limits while 18 gas wells were drilled in the Pierce Pool in the same county. The five deep discoveries are: the four Onondaga Chert-Oriskany Sandstone discoveries in Cambria County—the Rager Mt. Field in Jefferson County—the Elk Run Pool in Westmoreland County—the Duquesne Pool, the Tunnel Pool, and the Medina discovery in Erie County—the Dennee Pool.

There were 893 new wells drilled and 28 wells deepened during 1965. Of the 893 new wells, 865 were in proven fields and 28 were exploratory tests (all deep wells). Of the 865 proven-field wells, 660 were drilled outside of underground gas storage and secondary recovery projects, 198 were drilled in secondary recovery projects, and seven were in gas storage projects. Of the 660 development wells outside secondary recovery projects and gas storage, 325 were oil wells, 247 were gas wells, and 88 were dry holes. The total footage drilled during the year was 1,862,352 feet.

Exploratory tests totaled 28, drilling a total of 197,409 feet of hole. Of the 28 tests, 5 were successful and 23 were dry, giving a success ratio of 1 in 5.6.

Crude oil production during 1965 amounted to 4,855,000 barrels which is down from the 1964 production of 5,113,000 barrels. Proved oil reserves as of December 31, 1965 were estimated at 81,865,000 barrels. Natural gas produced totaled 82,662,000 Mcf as compared with 85,322,000 Mcf in 1964. Gas reserves were estimated at 1,257,028,000 Mcf at the end of the year. The amount of gas stored in Pennsylvania reservoirs on December 31, 1965 was 509,579,000 Mcf and this amount is included in the above reserve figure. The amount of distillate produced in 1965 was 67,000 bbls. The distillate reserve as of the last day of 1965 was 1,311,000 bbls.

Seismic activity in the Commonwealth was down 35 percent from 1964. Seismic crews logged 65 weeks during the year.

Studies of selected deep gas pools show the following results:

(1). *Dry Ridge Pool.* The Dry Ridge Pool in Westmoreland County produces gas from both the Onondaga Chert and the Oriskany Sandstone. The pool is closed by two high angle reverse faults which parallel the crest of an anticline.

(2). *Kastle Medina Field.* The Kastle (Lower Silurian) Medina Gas Field discovered in 1962 and put on line in 1965 was geologically investigated. Available data indicate the field to be primarily a stratigraphic trap with thin porous reservoir sandstones of the Grimsby and Cabot Head occurring in narrow, westerly trending belts subparallel to the interpreted local Silurian shoreline. The most productive wells are associated with lenticular pods of maximum reservoir sand development within these near-shore belts. Lithologic-economic parameters useful in exploration and exploitation are outlined and discussion of completion, production, field limits, and possible genesis of deposits should aid operators in an evaluation of the Medina as a drilling objective elsewhere in the State.

(3). *Bedford County deep gas.* Four Ridgeley gas fields and one gas pool in southern Bedford County occur on thrust-faulted anticlines in the Broad Top synclinorium. Faulting and anticlinal plunge cause the gas entrapment.

INTRODUCTION

The oil and gas developments during 1965 in Pennsylvania are summarized in this publication. The deep-well (those which reached rocks of Middle Devonian age or older) skeletal logs are shown in Table 10. For those deep wells drilled prior to 1950 the skeletal logs and other information on the Commonwealth's oil and gas activities are to be found in Bulletin M-31; similar information for the 1950 to 1954 period was published in Bulletin M-39 and for the 1955 to 1959 period in Bulletin M-45. For the years 1960, 1961, 1962, 1963, and 1964 this information was published in Progress Reports 158, 160, 165, 166, and 168 all of the Fourth Series of the Pennsylvania Bureau of Topographic and Geologic Survey. Oil and gas developments of the shallow sands (Upper Devonian or younger) are described in Bulletin M-45 and Progress Reports 135, 139, 143, 144, 147, 150, 151, 154, 155, 157, 158, 160, 165, 166, and 168 of the Survey.

A list of deep-well samples on file with the Survey is published in the Survey's "Catalogue of Deep Well Samples" (Inf. Circ. 16). Supplemental lists are published in Progress Reports 157, 158, 160, 165, 166, and 168. Many shallow-well samples are also on file with the Survey, but a list has not been published.

Deep-well drilling was down 18 percent in 1965 from that in 1964. Of the 123 deep wells (Middle Devonian or older) drilled during the year, 28 were wildcats, the same number of wildcats as were drilled in the past two years. Erie County in northwestern Pennsylvania had the

greatest density of deep drilling with 70 completions during the year. The Bushnell-Lexington Pool had 46 development gas wells drilled within its boundaries while the Pierce Pool had 18. The 123 deep wells consisted of 87 gas wells, 6 drilled for gas storage, and 30 dry holes. One of the discovery tests was drilled to basement before being completed as a Medina (Lower Silurian) discovery. Also one of the dry exploratory tests was abandoned above the Tully. The total deep footage amounted to 583,800 ft. (feet). Rotary tools completed 108 deep wells during the year most of which were air rotary; 15 were completed with cable tools.

Drilling activity in the shallow-sand (Upper Devonian or younger) territory of western Pennsylvania decreased 3 percent in 1965 from the number drilled in 1964. The decrease reflects the drastic reduction in wells drilled in connection with secondary-recovery oil operations. The price of Pennsylvania-grade crude oil remained steady during the year. There were 490 shallow-sand oil and gas development wells drilled during 1965 plus 1 gas storage well, 28 wells drilled deeper (gas, oil, and dry) and 198 wells drilled in connection with secondary-recovery oil operations. The total number of shallow wells drilled and deepened in Pennsylvania during 1965 was 798 with a total footage of 1,278,552 ft.

The production during 1965 in the Commonwealth amounted to 4,855,000 bbls. (barrels) of crude oil and 82,662,000 MCF (thousand cubic feet) of natural gas. The proved recoverable reserves in December 31, 1965 were 81,865,000 bbls. of crude oil and 1,257,028,000 MCF of natural gas. The amount of gas stored in the Pennsylvania reservoirs on December 31, 1965 was 509,579,000 MCF and this amount is included in the above reserve figure. The amount of distillate produced in 1965 was 67,000 bbls. The distillate reserve as of the last day of 1965 was 1,311,000 bbls. The natural gas and distillate figures are those published by the American Gas Association.

A classification of the wells, exclusive of those drilled for gas-storage and secondary-recovery purposes is given in Table 1, and oil and gas production is shown in Table 2. Figure 1 shows the annual gas production in the State since 1882.

Table 1.—*Deep and shallow well completions Summary, Pennsylvania, 1965**

Completions	*Oil*	*Gas*	*Dry*	*Total*	*Percent Successful*
Exploratory tests	0	5	23	28	18
Development wells*	325	247	88	660	87
Totals	325	252	111	688	84

*Does not include wells drilled in connection with underground gas storage or secondary-recovery operations.

Table 2.—*Production in Pennsylvania, 1965*

	1964	*1965*	*Cumulative total to 12/31/65*	*Reserves 12/31/65*
Oil (bbls.)	5,113,000	4,855,000	1,256,192,000	81,865,000
Gas (MCF)	85,322,000	82,662,000	7,856,270,000	1,257,028,000

The Pennsylvania Game Commission did not execute any oil and gas leases during the year. Two dry holes were drilled on the Game Commission acreage during 1965. At the year's end a total of 23 leases totaling 12,906 acres containing 22 productive wells on 14 leases were operating on their lands.

The Pennsylvania Department of Forests and Waters received acceptable bids for 7 tracts totaling 154,041 acres. These tracts which are located in Cameron, Potter, Fulton, and Tioga Counties drew bonus bids ranging from $1.00 to $9.23 per acre. The overall average was $3.19 per acre. One tract comprising 3,960 acres brought $36,557 or $9.23 per acre. A total bonus of $77,797 was received for these tracts which carry an annual rental of $1.00 per acre. They require a royalty of $.04 for each thousand cubic feet of gas produced. At the present time there are 170,618 acres of State Forest land under lease for oil and gas exploration and development.

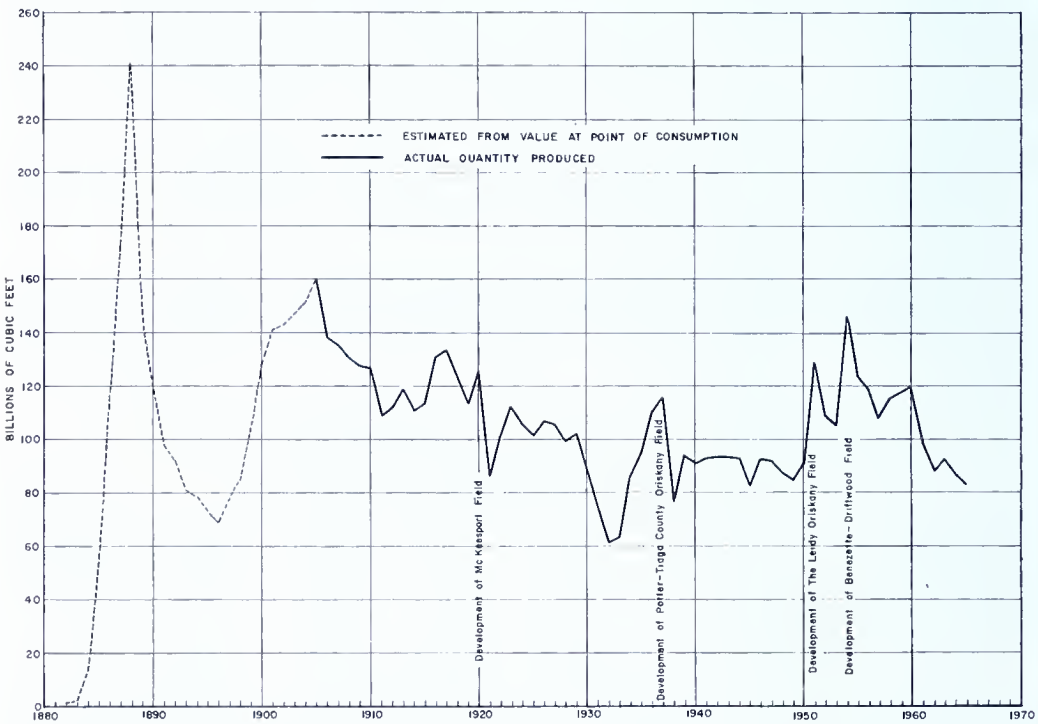


Figure 1. Annual production of natural gas in Pennsylvania.

Oil and gas exploration and development activities in 1965 have resulted in a total income of $619,638 from rental and royalty payments. Royalty payments to December 31, 1965 amounted to $295,477 for 3,836,-893 MCFG (thousand cubic feet of gas) and $19,528 for 4,650 bbls. of oil produced on Department lands. Rental payments to the end of the year total $324,161 for undeveloped leases, storage, pipeline rights-of-way, compressor and pumping stations, and seismic surveys.

Seven seismic survey permits were issued in 1965 by the Department of Forests and Waters. Geophysical surveys consisting of approximately 28 miles of traverse were conducted across State Forest lands. The traverses evaluated the subsurface conditions underlying portions of six geologic structures located in Fulton, Centre, Tioga, Somerset, Indiana, Cambria, and Fayette Counties.

Seismic activity in the Commonwealth was down 35 percent from the seismic activity of 1964. Seismic crews logged 65 crew weeks during the year.

A special survey conducted by the Bureau has found that 17,516 gas wells are producing in the State.

ACKNOWLEDGMENTS

The writers acknowledge the cooperation, in the preparation of this review, of the Bradford District Producers Association, the Northeastern Gas and Oil Scouts, and the following Commonwealth agencies: Game Commission, Department of Forests and Waters, and Department of Mines and Mineral Industries. Virginia Fairall and Francis O'Donnell of the Pennsylvania Bureau of Topographic and Geologic Survey did the drafting. Virginia Fairall and Eileen McClure, also of the Survey staff, assisted with the compiling of the data.

SHALLOW-SAND EXPLORATION AND DEVELOPMENT

Exploration and development of shallow sand horizons continued at an accelerated pace during 1965. Figure 2 shows the distribution of shallow-sand wells drilled between 1950 and 1965.

During 1965 a total of 571 shallow wells were drilled for primary oil and gas production (i.e. exclusive of wells drilled deeper and those drilled in connection with underground gas storage and the secondary recovery of oil). This total surpasses the 551 wells drilled in 1950. Between

Table 3.—*Shallow-sand well completions in Pennsylvania, 1965**

	TOTAL		GAS			OIL			DRY	
	No. of Wells	*Aver. Total Depth (Feet)*	*No. of Wells*	*Aver. Init. Open-Flow (MCFPD)*	*Aver. Total Depth (Feet)*	*No. of Wells*	*Aver. Init. Prod. (BOPD)*	*Aver. Total Depth (Feet)*	*No. of Wells*	*Aver. Total Depth (Feet)*
Allegheny	4	2,648	4	2,073	2,648	..	..	..	..	..
Armstrong	43	2,998	39	537	3,089	1	2½	1,651	3	2,275
Beaver	5	1,282	..	..	..	3	4½	1,241	2	1,342
Butler	6	1,939	4	34	2,178	1	..	1,119	1	1,800
Clarion	17	2,046	13	132	2,315	2	100	1,077	2	1,270
Clearfield	3	3,450	3	554	3,450	..	..	..	..	..
Elk	6	2,519	4	53	2,478	..	..	..	2	2,601
Forest	36	1,137	2	536	1,573	22	25	840	12	1,608
Greene	2	1,222	..	..	..	1	20	1,194	1	1,251
Indiana	55	3,325	50	1,373	3,361	..	..	..	5	2,966
Jefferson	29	3,376	28	1,313	3,375	..	..	..	1	3,409
Lawrence	1	955	..	..	..	..	..	..	1	955
McKean	46	1,781	2	..	2,484	23	11	1,449	21	2,078
Potter	7	1,505	1	5	1,996	6	..	1,423	..	..
Venango	82	759	..	..	..	69	22	728	13	923
Warren	207	852	..	..	..	195	42	820	12	1,358
Washington	7	1,528	2	165	1,399	2	11	1,567	3	1,589
Westmoreland	14	3,199	12	1,719	3,110	..	..	..	2	3,726
Wyoming	1	1,397	1	30	1,397	..	..	..	..	..
Total	571	1,628	165	1,034	3,056	325	34	873	81	1,765

* *Does not include wells drilled in connection with underground gas storage or secondary-recovery oil operations.*

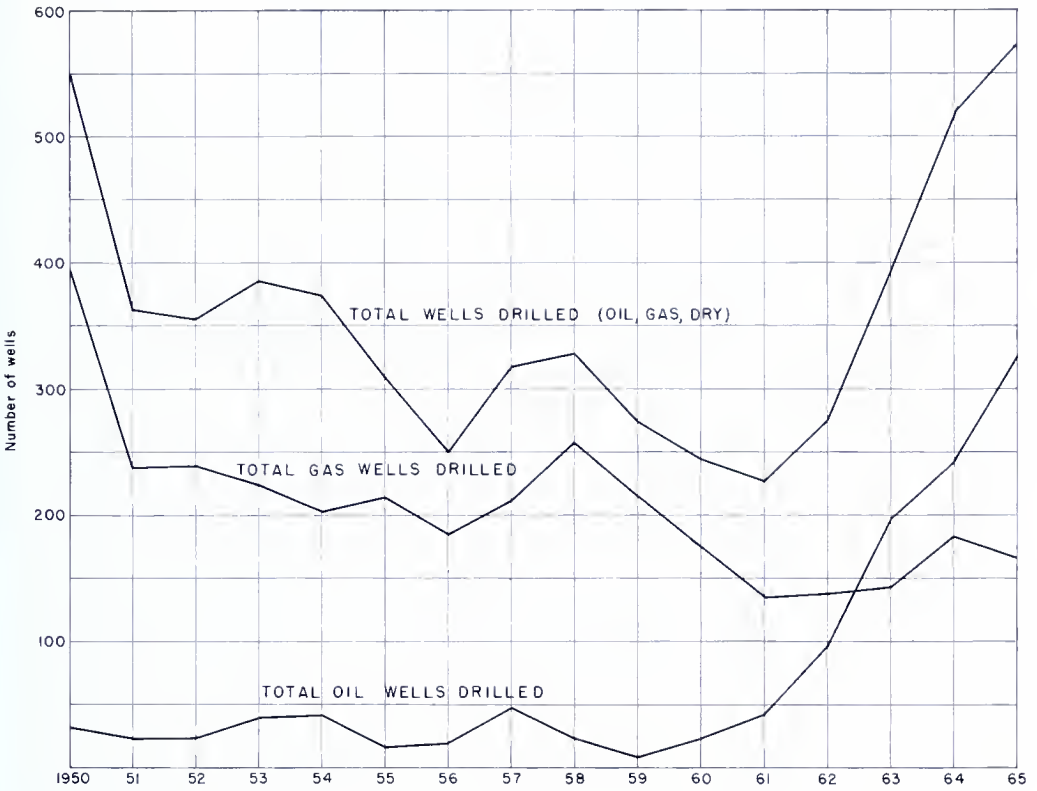


Figure 2. Graph showing shallow well activity in Pennsylvania, 1950-1965.

1962 and 1965 drilling for shallow-well primary oil production has shown an increase of over 200 percent (Figure 2). The wells drilled in 1965 are categorized as follows: 165 gas wells, 325 oil wells and 81 dry holes; in addition, 1 gas storage well, 28 wells drilled deeper (gas, oil and dry) and 198 wells drilled in connection with secondary-recovery oil operations are included. The total number of shallow wells drilled and deepened in Pennsylvania during 1965 was 798 with a total footage of 1,278,552 feet. This total is down 23 wells from last year. However, this reduction in total wells reflects a drastic reduction in wells drilled in connection with secondary-recovery oil operations, i.e. 198 wells drilled, down 80 wells from the 278 wells in 1964. Table 3 displays the shallow-sand well completions in Pennsylvania exclusive of those drilled in connection with secondary-recovery oil operations and underground gas storage. Table 4 shows the results of deepening 28 shallow wells in 1965. The generalized stratigraphic positions of the productive oil-and gas-producing sands in western Pennsylvania are shown on Figure 3.

Due to the rather unsatisfactory method of reporting shallow wells in Pennsylvania, the totals represented here, especially in the primary oil exploration and development, are unrealistically low. These figures should be upgraded for any regional drilling-activity appraisal.

Table 4.—*Shallow-sand wells deepened in Pennsylvania, 1965**

	TOTAL		GAS			OIL			DRY	
	No. of Wells	*Aver. Amt. Deepened (Feet)*	*No. of Wells*	*Aver. Init. Open-Flow (MCFPD)*	*Aver. Amt. Deepened (Feet)*	*No. of Wells*	*Aver. Init. Prod. (BOPD)*	*Aver. Amt. Deepened (Feet)*	*No. of Wells*	*Aver. Amt. Deepened (Feet)*
Allegheny	1	1,395	1	2,069	1,395	..	..	..	..	..
Armstrong	12	1,084	12	449	1,084	..	..	..	..	..
Forest	1	130	..	..	..	..	..	..	1	130
Greene	1	920	..	..	..	..	..	..	1	920
Indiana	11	1,292	10	504	1,213	..	..	..	1	1,978
Jefferson	1	349	..	..	..	..	..	..	1	349
Westmoreland	1	2,033	1	2,169	2,033	..	..	..	..	..
Total	28	1,144	24	623	1,190	..	..	..	4	869

* *Does not include wells drilled in connection with underground gas storage or secondary-recovery oil operations.*

SHALLOW-SAND GAS DEVELOPMENTS

During 1965, 165 new shallow gas wells were completed in Pennsylvania. This shows a decrease of 19 wells over the reported total of 1964. This decrease is not reflected in any one site of activity. A comparison of the 1964 gas activity with the 1965 gas activity indicates that the decrease is spread over the entire gas-producing area.

During 1965, a combined, total, initial open-flow capacity of 161 of these wells gauged 166,596 MCFGPD (thousand cubic feet of gas per day) compared with 125,675 MCFGPD gauged from 179 wells in 1964. In wells where reservoir stimulation was utilized, the open-flow gauges obtained after stimulation were used in the computations. Hydrofracturing was applied to 139 of the 165 new gas wells and yielded a total open-flow capacity of 136, 481 MCFGPD for 138 wells. A comparison of open-flow gauges taken before and after stimulation shows the following results: 112 wells gauged a total open-flow capacity of 4014 MCFGPD before stimulation; after stimulation these same 112 wells gauged a total open-flow capacity of 113,877 MCFGPD. Hydrofracturing was applied to 23 of the 24 gas wells drilled deeper. A comparison of before-and after-stimulation production rates shows that the total initial open-flow capacity of 15 wells before stimulation was 227 MCFGPD and 11,276 MCFGPD after stimulation.

This distribution of shallow gas drilling in 1965 remains essentially the same as in 1964 (Figure 2). The drilling activity in the Big Run area in Gaskill Township, Jefferson County and Banks Township, Indiana County remains at a level similar to that of 1964; however, the field limits are extending to the east into Bell Township, Clearfield County and to the north into Henderson Township, Jefferson County and Brady Township, Clearfield County. Completions in the Big Run Field as well as in most of the remaining gas-productive areas of the State (namely, in Armstrong and Clarion Counties) were made in the Speechley, Balltown, Tiona, Bradford and Kane sands (Figure 3).

SHALLOW-SAND OIL DEVELOPMENTS

Shallow oil completions have continued to climb in Pennsylvania. During 1965, 325 primary oil well completions were reported in Pennsylvania. This tabulation shows an increase of 83 wells over the 1964 activity. Figure 2 shows the dramatic increase of shallow-oil exploration and development since 1961. This large increase is mainly confined to five specific areas.

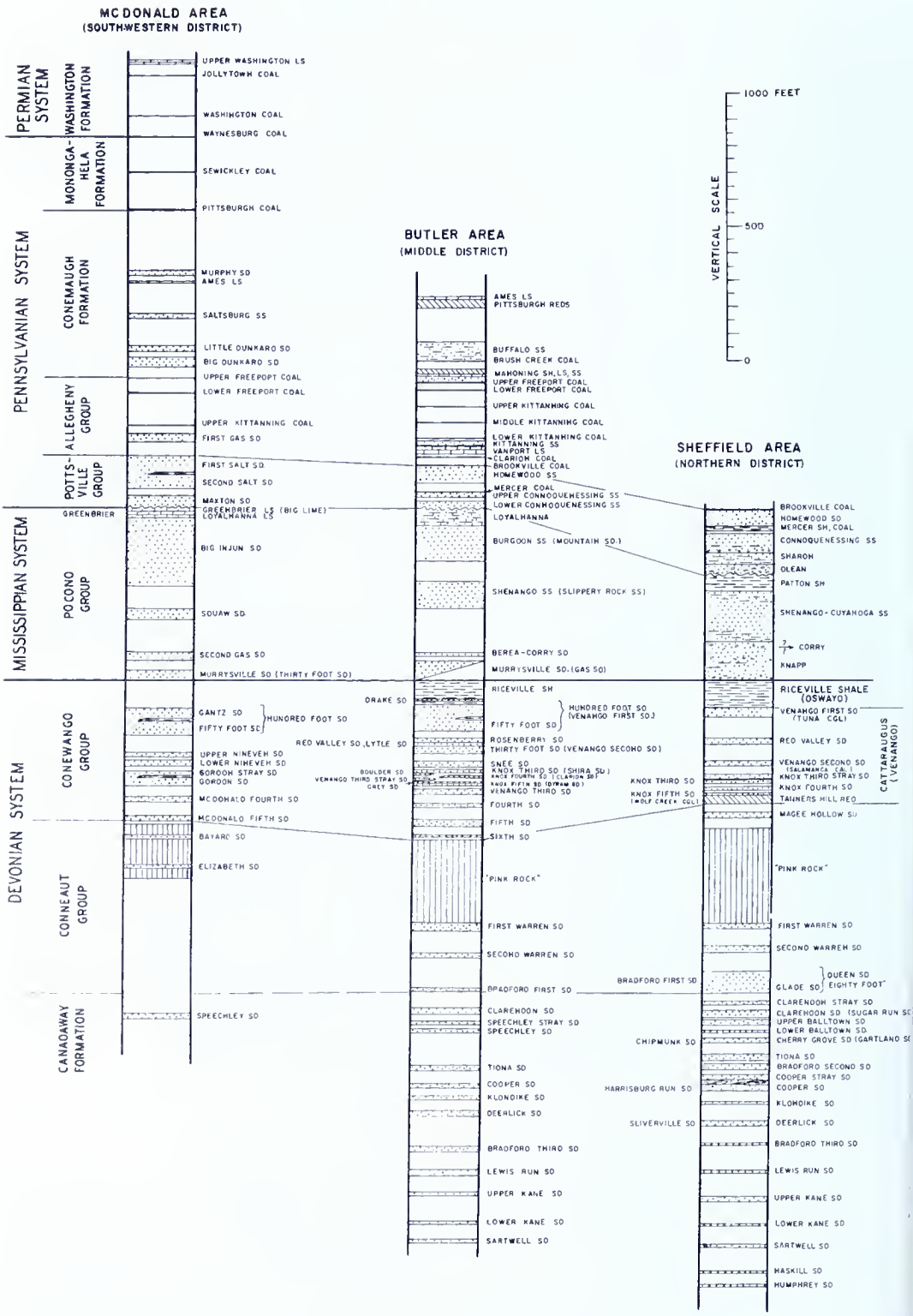


Figure 3. Columnar section showing oil and gas sands of western Pennsylvania.

Oil production in Pennsylvania averaged 13,302 BOPD in 1965 as compared with 14,008 BOPD for 1964. The total oil production for Pennsylvania during 1965 was 4,855,327 BO or 257,673 BO less than the total oil production of 1964. Virtually all of this loss was in the Pennsylvania portions of the Bradford Field. The daily average production for the Pennsylvania portion of the Bradford Field was 7,730 BOPD in 1965 as compared with 8,449 BOPD during 1964. In the Middle and Southwestern Districts of Pennsylvania the daily average production in 1965 was 5,573 BOPD as compared with 5,559 BOPD in 1964. Table 5 shows the number of oil wells and crude oil production by counties in Pennsylvania for 1964.

Crude oil prices have remained stable since January 11, 1964 at $4.48 (Bradford District), $4.20 (Middle District) and $3.93 (Southwestern District).

Figure 4 shows the annual production of crude oil in Pennsylvania from 1859 to 1965. The crude oil production of the Bradford District is shown in Figure 5. The monthly variation in crude oil price, produc-

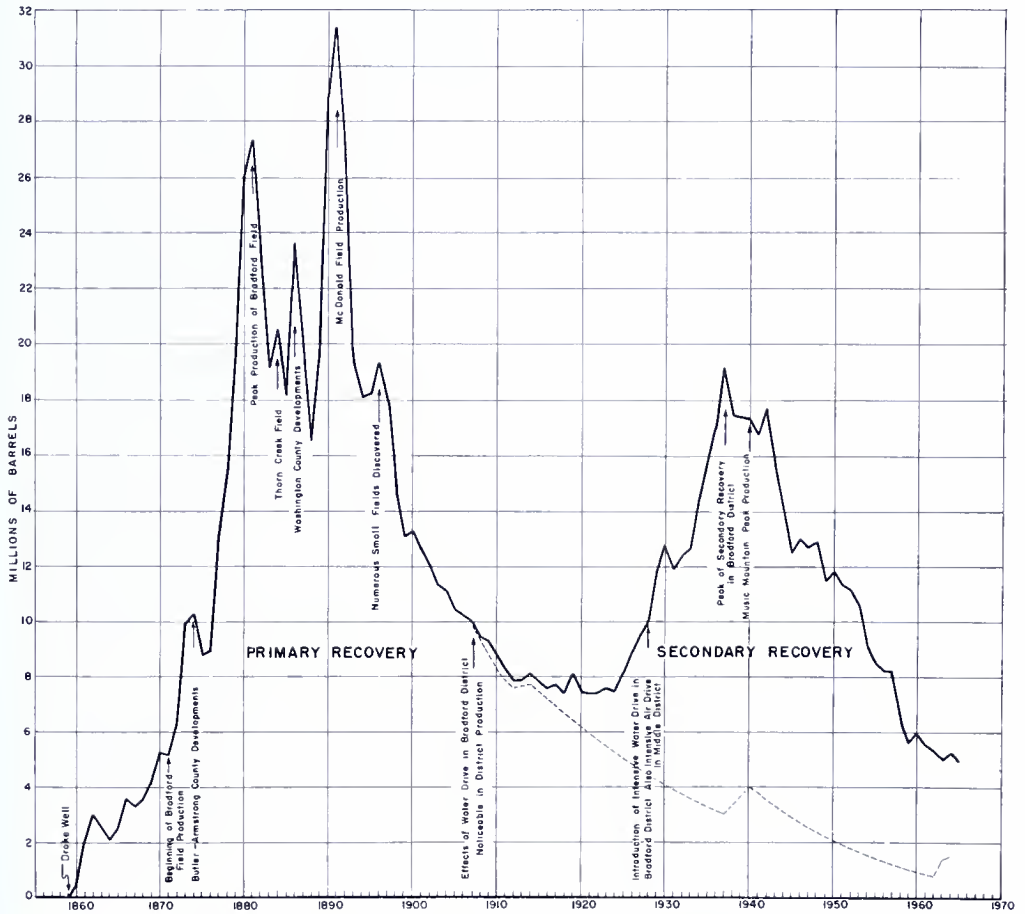


Figure 4. Annual production of crude oil in Pennsylvania.

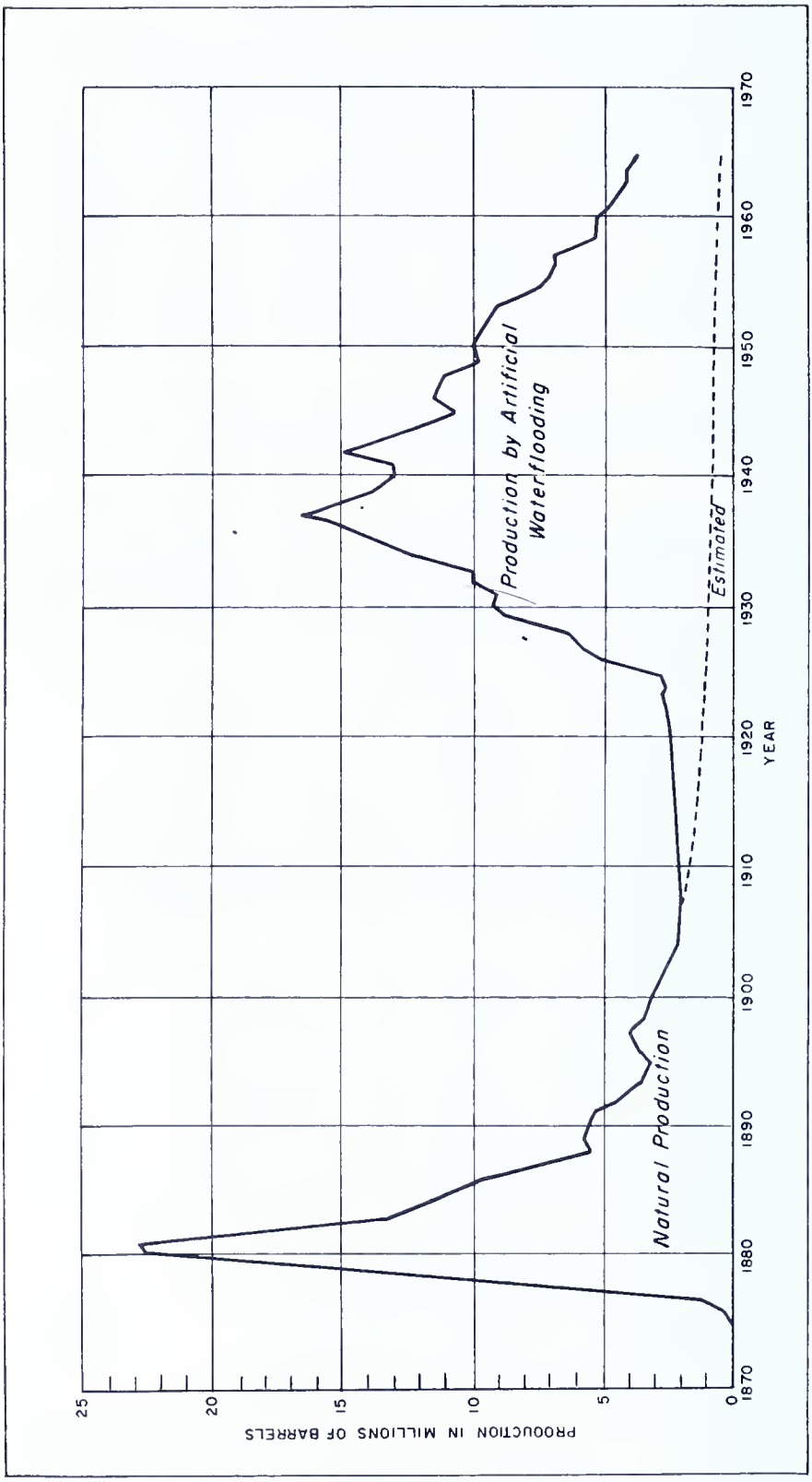


Figure 5. Crude oil production curve of the Bradford District, Pennsylvania and New York. (Music Mt. Field excluded)

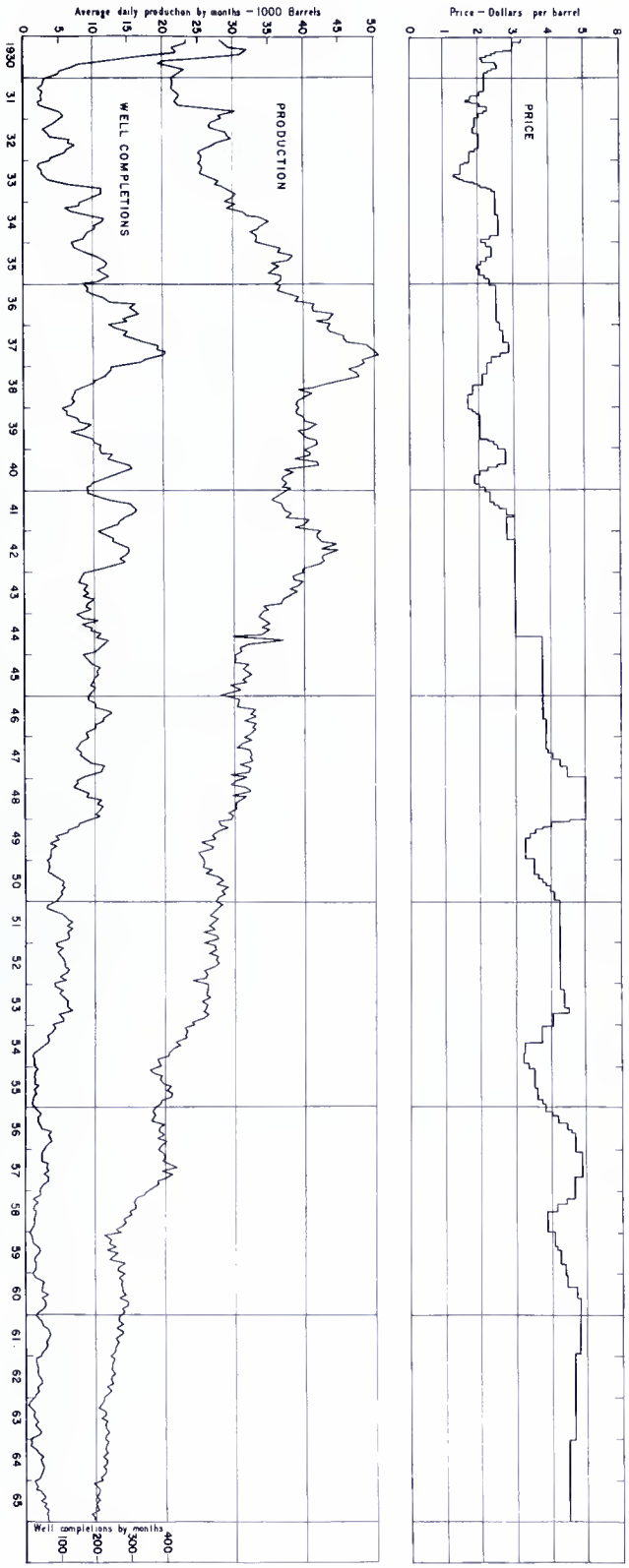


Figure 6. Crude oil prices, production, and well completions, Bradford Field.

Table 5.—*Oil wells and crude oil production in Pennsylvania by counties, 1964**

County	*Number of producing oil wells as of 12/31/64*	*Crude oil production (bbls.)*
Allegheny	385	111,598
Armstrong	137	10,516
Beaver	122	9,258
Butler	2,325	146,913
Clarion	813	55,875
Crawford	612	26,218
Elk	669	48,594
Fayette	4	248
Forest	933	66,053
Greene	300	53,625
Jefferson	87	3,803
McKean	21,928	3,105,826
Mercer	116	2,130
Potter	354	42,832
Tioga	16	370
Venango	14,736	297,869
Warren	8,358	653,389
Washington	827	154,991
Total	52,731	4,790,108

* Data from Bureau of Statistics, Department of Internal Affairs, Harrisburg, Pennsylvania.

tion and well completions is plotted on Figure 6 for the years 1930 to 1965 for the Bradford Field.

SITES OF IMPORTANT OIL AND GAS ACTIVITIES DURING 1965

The important sites of oil and gas activity for 1965 are noted on Figure 7 and described below:

1. *Section 9 (I)—Corry quadrangle (Warren County)*

During 1965, 17 oil wells and 3 dry holes were drilled in this area. The Venango "Fourth sand" continued to be the major objective. Most of the wells were stimulated by hydrofracturing and some were undoubtedly notched. Initial potentials have continued to average about 20 BOPD (barrels of oil per day).

According to reliable reports, a Rocky Mountain independent producer plans to initiate a pilot steam flood in the Venango "First sand" during the spring of 1966. This project is located several miles northwest of the current Venango "Fourth sand" activity in the area. Some of the preliminary wells for this project were drilled during 1965.

2. *Youngsville-Sugar Grove Fields (Warren County)*

Exploration and development of these two large fields continued at

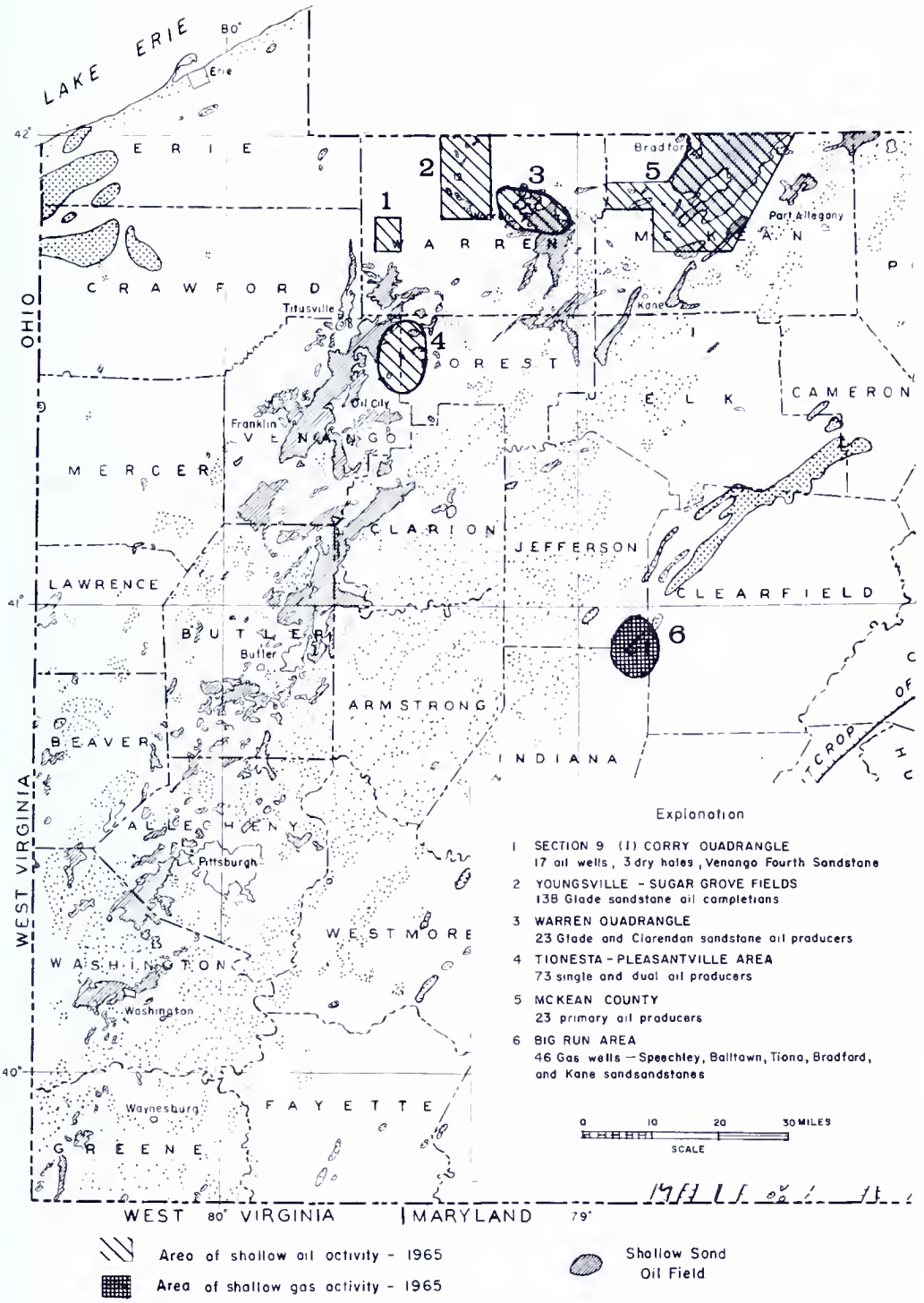


Figure 7. Sites of important shallow-sand oil and gas activities in 1965.

a brisk pace during 1965. Most of the activity seemed to be concentrated in the Irvine Run, Chandlers Valley and Sugar Grove portions of the fields. During the year 138 new Glade sandstone oil completions were made in the area. Several dry holes were drilled in the western portion of the Youngsville quadrangle. Most of these oil completions were stimulated by notching and hydrofracturing. Two gas injection projects were active in the Youngsville quadrangle during 1965. One is located on the western edge of Youngsville borough and the other near Chandlers Valley. At least one additional gas injection project will be put on stream during 1966 in the Sugar Grove area.

3. *Warren quadrangle (Warren County)*

Activity in the quadrangle has extended westward into Pleasant and Conewango Townships adjacent to the Allegheny River. During 1965, 23 Glade and Clarendon sandstone oil producers were completed in this area. The bulk of these oil wells are in the Glade. Notching and hydrofracturing have been utilized in most completions and an average initial potential was 34 BOPD.

4. *Tionesta-Pleasantville area (Forest and Venango Counties)*

This area follows the Youngsville-Sugar Grove Fields in drilling activity. This site includes portions of Harmony and Tionesta Townships in Forest County and Allegheny and President Townships in Venango County. During the year 73 oil wells and 5 dry holes were drilled here. This area is particularly attractive because of its multi-pay potential, including the Venango First, Red Valley, Venango Second (Salt), and Venango Third (multi-layered) sandstones (Figure 3). The Red Valley is the primary objective and it usually accounts for about 65 percent of the completions in a single zone well. During 1965, over 30 percent of the oil completions were dual. Most of the dual zone wells were from the Red Valley and the Venango Second (Salt) sandstones. The majority of these wells have been notched and hydrofractured. Initial potentials average about 25 BOPD.

Figure 8 shows a representative Gamma-Ray Neutron log of a well in the area. It is likely that as exploration and development drilling continues in the Tionesta-Pleasantville district, increased attention will be given to other prospective pays in addition to the Red Valley and Venango Second (Salt) objectives.

5. *McKean County*

Twenty-three primary oil wells were completed in Lafayette, Corydon, Foster, Bradford, Keating and Eldred Townships during 1965. Data are very sketchy but it appears that most of the completions were made in post-Bradford Third rocks.

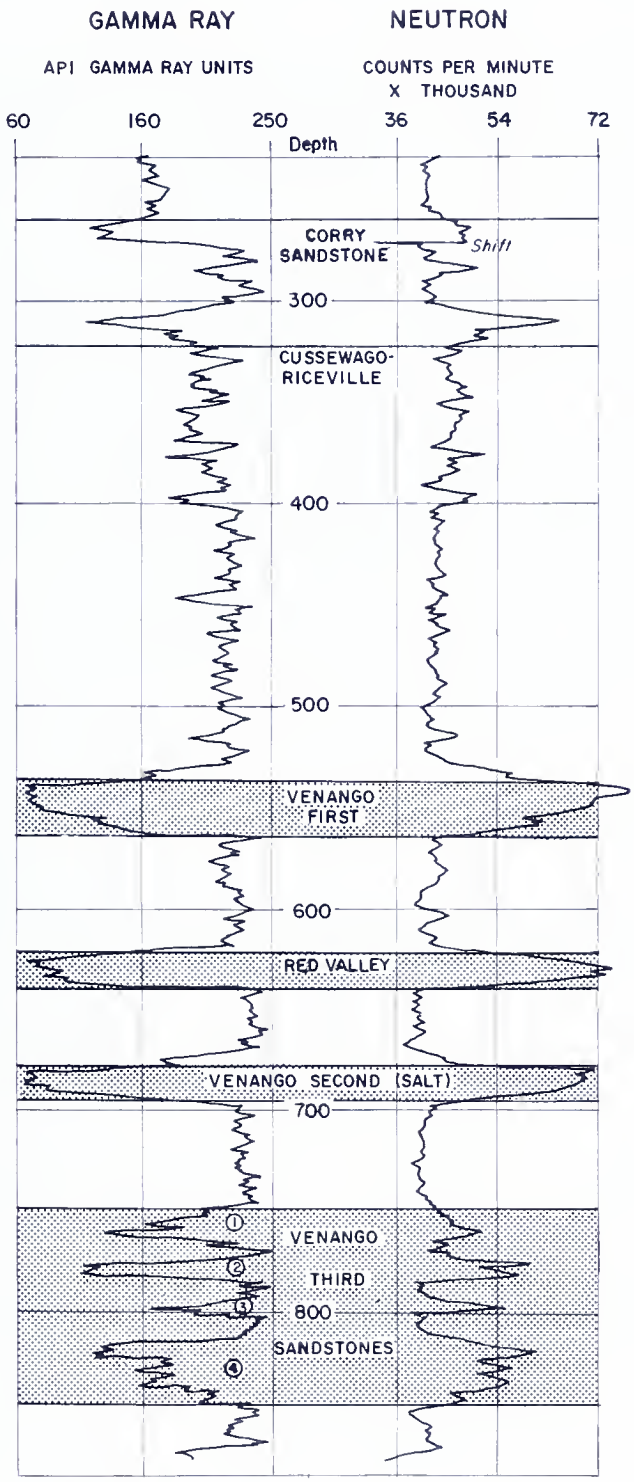


Figure 8. Typical gamma-ray neutron log of producing section Venango First through Venango Third in Tionesta-Pleasantville area, Forest and Venango Counties, Pennsylvania.

6. *Big Run area (Gaskill, Henderson Townships, Jefferson County; Banks Township, Indiana County; and Bell, Brady Townships, Clearfield County)*

Activity in this area has increased considerably during 1965. During the past year 46 gas wells were completed in this field and the limits of the field were pushed eastward into Bell Township, Clearfield County and northward into Brady Township, Clearfield County and Henderson Township, Jefferson County. All of these wells were stimulated by hydrofracturing. A comparison of gauges before and after stimulation shows a total, combined, open-flow gauge of 530 MCFGPD before stimulation and 48,951 MCFGPD after stimulation. These wells are economically attractive because of their multi-pay potential. Prospective sandstones include the Speechley, Balltown, Tiona, Bradford and Kane.

J. G. Dyer and the Consolidated Royalty Oil Company are continuing their pilot water-flood project in the old Bear Creek Field, Parker Township, Butler County. Flooding operations have been in effect since the latter part of 1964. The operator is pumping 600 barrels of water a day into the Knox Third sand through seven input wells. The project engineer has indicated that the estimated fill-up has not been reached and hence no noticeable increase in oil production has been observed.

COMMENTS—SHALLOW WELL ACTIVITY

Upon completion of an analysis of the statistics and the scanty geological data available from the 1965 shallow-well activity, the following observations are made:

(1) Development in the traditional secondary-recovery oil areas of the State is decreasing and thus understandably so is the total production of oil.

(2) The search for new reserves of shallow oil and gas is gaining momentum. However, the discovery of new oil reserves is not yet enough to offset the declining production of the secondary-recovery areas.

(3) The application of modern techniques such as logging, notching, hydrofracturing, perforation through casing, etc. is gaining widespread acceptance in the oil and gas fields of western Pennsylvania.

(4) Many out-of-state and local operators now realize that long-abandoned oil pools previously untouched for secondary recovery are now good prospects for steam flood, water flood and gas injections. The response of these wells to modern stimulation practices plus the knowledge of the huge reserves still available in these rocks has renewed the interest.

(5) If the interest to maintain and expand the shallow-well potential of the State is to continue, it is now exceedingly important to develop new regulatory practices whereby uniform, accurate and adequate geological and production data are available to the oil and gas industry. Virtually all of the easily located accumulations of shallow oil and gas in the State have been found. New and economically attractive reserves of oil and gas can now be found only with the most careful use of sound geological and engineering data.

DEEP-SAND EXPLORATION AND DEVELOPMENT

The 1965 deep-sand exploration in Pennsylvania resulted in the discovery of three new deeper gas pools, one new gas pool, and one new gas field. Development drilling extended several gas fields and pools. The drilling of 82 wells in Erie and Crawford Counties was down somewhat from that in 1964 when 92 wells were drilled. As in the last two years 28 wildcats were drilled. The producing depth record established in 1964 still stands. The record is held by the Leo F. Heyn No. 1 well in Fayette County which found gas in commercial quantities in the Tuscarora (Medina, Lower Silurian) at a depth of 11,510 ft. The drilling depth record was established last year when the No. 1 J. F. Long well in Centre Co. reached a total depth of 15,662 ft. in the Black River (Middle Ordovician).

Figure 9 shows the annual rate of deep-sand exploration and development. Figure 10 shows the stratigraphy of the Minard Run Oil Company No. 1 well drilled in Bradford Township, McKean County in 1962. The locations of all the deep wells drilled in Pennsylvania during 1965 are indicated on Figure 11.

At the end of 1965 a total of 2,681 deep wells had been drilled in the Commonwealth. Of the 2,681 deep wells, 1559 were gas wells, 6 were oil and gas wells, 1020 were dry holes, 93 were drilled for gas storage, and 3 are being used for waste disposal.

During the year 120 wells were drilled to the Oriskany Formation or deeper, of which 76 were Medina gas wells, 11 were Oriskany gas wells, 30 had shows of gas or were dry holes, and 6 were drilled for gas storage. Of the 123 deep wells completed during the year, 88 wells were fractured and 78 of these wells were completed as commercial gas wells.

The deep footage amounted to 583,800 ft. Rotary tools completed 108 deep wells during the year, mostly with air rotary, and 15 were completed with cable tools.

The Bushnell-Lexington Pool in Erie County had 46 wells drilled

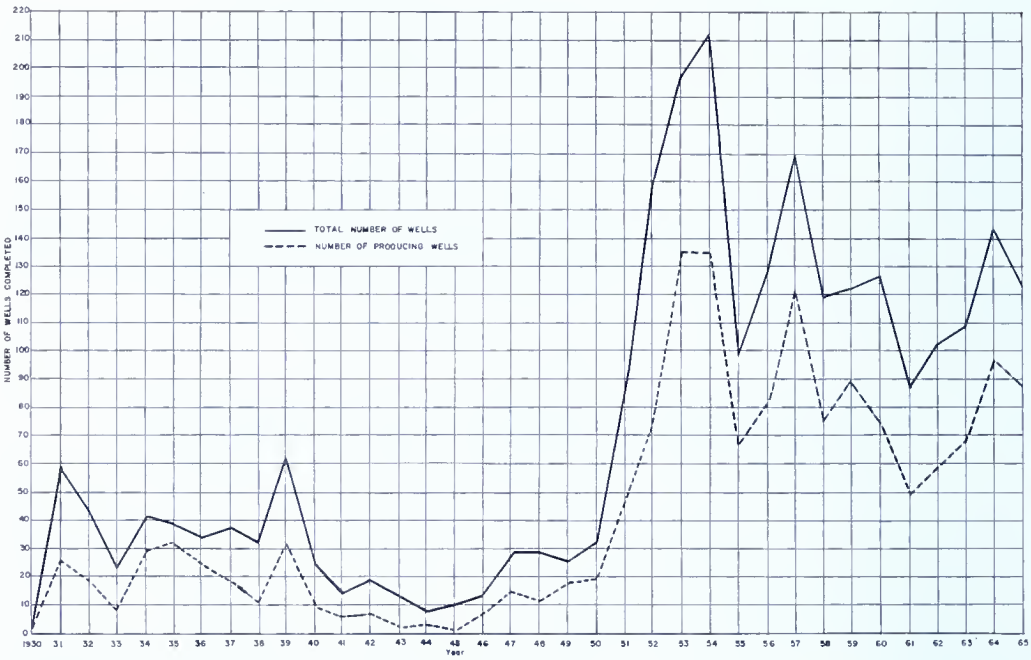


Figure 9. Annual rate of deep sand exploration and development.

within its limits during the year; all were commercial gas wells. The Pierce Pool in the same county had 18 development gas wells drilled within its borders. In Crawford County six development wells were drilled in the Indian Spring Pool; five of them were commercial gas wells. The deeper well completions for Pennsylvania for 1965 are summarized in Table 6. Table 9 shows the 1965 gas production from the Commonwealth's deep gas reservoirs.

Table 6.—*Summary of deep-well completions in Pennsylvania, 1965*

	Development		*Wildcat*		*Storage*	*Total*
Gas	82		5		6	93
Dry		7		23		30
Footage	308,586	43,844	38,715	158,694	33,961	583,800

DEVELOPMENT IN THE DEEP GAS FIELDS

Table 7 lists the important discoveries of 1965 while Table 8 lists the important dry exploratory tests.

In Beaver County Peoples Natural Gas Company drilled a step out to the South Beaver Oriskany Field in South Beaver Township. The well, Frank Cole No. 1 (No. 1, Figure 11, Table 10), was drilled to a total depth of 4806 ft. after finding the Oriskany at 4730 ft. After fracturing the well produced saltwater and was abandoned.

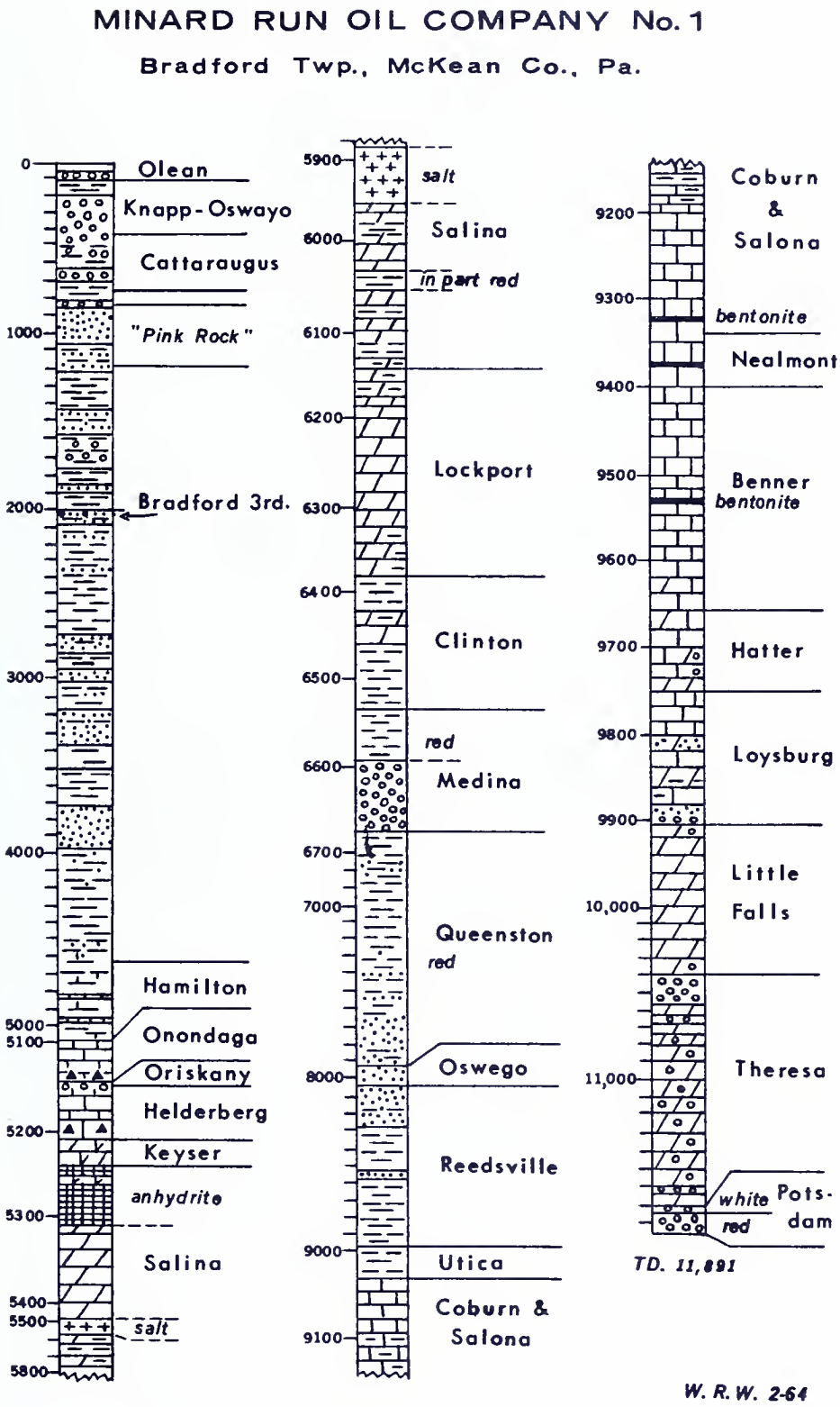


Figure 10. Stratigraphy of the Minard Run Oil Co. no. 1 well.

Table 7.—*Important discoveries in 1965, Pennsylvania*

Map No.	*County & Location*	*Operator, Well No., & Lease*	*Compl. Date (Month)*	*Basis For Loc.*	*Total Depth (Feet)*	*Deepest Formation Reached*	*Prod. Depth (Feet)*	*Producing Formation or Zone*	*Init. Prod. (Mcf)*	*Field or Pool Name*	*Explor. Class*	*Remarks*
	Cambria Co.											
6	Jackson Twp.	Bethlehem Steel Co. et al., George L. Reade 1	10/16	Sur. Geol., Seis.	7,810	Oriskany	7696-7810	Onondaga Chert-Oriskany	8,200 Nat.	Rager Mt.	NFD	On Laurel Hill Anticline
	Erie Co.											
17	Venango Twp.	Consolidated Gas Serv. Corp. Blaine Dennee 1	10/8	Seis.	7,465	Precambrian	3762-3785	Medina	1,061 A.F.	Dennee	DPD	Basement Test
	Jefferson Co.											
24	Young Twp.	Consolidated Gas Serv. Corp. R. and P. Coal Co. 2	6/20	Sub. Geol., Seis.	7,198	Helderberg	7094-7193	Onondaga Chert-Oriskany	2,214 Nat.	Elk Run	DPD	On Sabinsville Anticline
	Westmoreland Co.											
35	Cook Twp.	Peoples Nat. Gas Co. J. S. Blair 4	3/10	Sub. Geol., Seis.	8,442	Helderberg	8202-8386	Onondaga Chert-Oriskany	11,000 A.F.	Tunnel	NPD	On Laurel Hill Anticline
34	Franklin Twp.	Fox, Coen and Sloan Duquesne Gas Co. 1	8/8	Sub. Geol., Seis.	7,794	Helderberg	7487-7726	Onondaga Chert-Oriskany	1,200 A.F.	Duquesne	DPD	On Murrysville Anticline

Table 8.—*Important Exploratory Failures in 1965, Pennsylvania*

Map No.	*County & Location*	*Operator, Well No. & Lease*	*Comp. Date M-D*	*Basis for Loc.*	*Total Depth (Feet)*	*Deepest Formation Reached*	*Explor. Class or Field*	*Remarks*
	Bedford Co.							
2	Napier Twp.	Kerr McGee Oil Ind. et al Shellsburg Unit 1	3/24	Sub. Geol., Seis.	11,850	Gatesburg	NFW	On Shellsburg Dome
	Clarion Co.							
8	Piney Twp.	Fairman Drlg. Co. H. Amsler 1	9/14	Sub. Geol.,	5,828	Salina	NFW	Oriskany Sandstone absent
	Clearfield Co.							
9	Burnside Twp.	Consolidated Gas Serv. Corp. N-963 Lilly Leamer	1/20	Sub. Geol., Seis.	8,353	Helderberg	NFW	Northwest flank of Laurel Hill Anticline
	Crawford Co.							
14	Beaver Twp.	Transamerican Pet. Corp. G. S. Sprouse 2	1/30	Sub. Geol., Seis.	6,189	Gatesburg	DPW	Between two Gatesburg pools
	Erie Co.							
17	Venango Twp.	Consolidated Gas Serv. Corp. Blaine Dennee	10/8	Seis.	7,465	Precambrian	DPW	Basement test in northwestern Pa.
	Fulton Co.							
20	Ayr Twp.	Consolidated Gas Serv. Corp. T. E. Nesbitt 1	11/5	Sur. Geol., Seis.	8,648	?	NFW	Started in Gatesburg on McConnellsburg Anticline
	Indiana Co.							
22	N. Mahoning Twp. .	Consolidated Gas Serv. Corp.	6/4	Sub. Geol., Seis.	7,511	Helderberg	NFW	Showed presence of Oriskany Sandstone
	Mercer Co.							
26	Lake Twp.	Peoples Nat. Gas Co. et al R. W. Temple 1	6/13	Sur. Geol. Seis.	9,919	Precambrian Granite	NFW	Basement test in western Pa.
	Wayne Co.							
32	Clinton Twp.	Humble Oil & Ref. Co. Hudson Realty Co. 1	4/25	Seis.	7,443	Hamilton	NFW	Middle Devonian test in northeastern Pa.

Bedford County had three wildcats and one dry development well. Kerr McGee Oil Industries drilled a wildcat well in Napier Township on the Shellsburg Dome. This wildcat, Shellsburg Unit No. 1 (No. 2, Figure 11, Table 10), was drilled to a total depth of 11,850 ft. after reaching the Mines Dolomite (Upper Cambrian). The well started in the Helderberg (Lower Devonian). Saltwater was found at 3327 ft. and the well was abandoned. The other two wildcats were drilled near the north and south boundaries of the Purcell Field. The one at the northern end of the field drilled through a fault and was abandoned above the Onondaga (Middle Devonian) at a total depth of 6121 ft. The well at the southern end found saltwater and a little gas in the Oriskany and was abandoned. A fourth well in the county was drilled in the Big Mountain Field. The well was abandoned after finding only a show of gas in the Oriskany.

In Cambria County Peoples Natural Gas Co. drilled a discovery well, George L. Reade No. 1 (No. 7, Figure 11, Table 10), on the Laurel Hill anticline in Jackson Township. The well found the Oriskany at 7796 ft. with a natural open flow of 8245 MCFGPD at a R.P. (rock pressure) of 3193 psi (pounds per square inch) in 168 hours. A second well was drilled in this county before the year's end confirming the discovery of the Rager Mt. Pool.

Cameron County had only one completion during the year. Felmont Oil Corp. drilled Emporium Lumber Co. No. 1 well (No. 8, Figure 11, Table 10) in Lumber Township on the southeast flank of the Sabinsville anticline. The wildcat was an Oriskany updip pinchout. After finding saltwater in the Oriskany the well was abandoned.

Clarion County had an Oriskany wildcat test drilled in Piney Township. The H. Amsler No. 1 well (No. 9, Figure 11, Table 10) was drilled by Fairman Drilling Co. in the so-called no-Oriskany-sand area. The Oriskany was found at 5488 but it was unproductive and was abandoned.

In Clearfield County two wildcats were drilled. Both wildcats were unsuccessful. The Lill Leamer No. 1 well (No. 10, Figure 11, Table 10) was drilled on the Nolo anticline while the John M. Chase (No. 11, Figure 11, Table 10) was drilled on the Laurel Hill anticline.

Crawford County was the second most active county in the Commonwealth with its 12 completions during the year. Five of the wells (Nos. 16, 19, 20, 21, 22) were drilled to the Gatesburg (Upper Cambrian) and all were dry in this formation. Two of the Gatesburg tests were wildcats. One of the wildcats was completed as a Medina gas producer and one of the dry Gatesburg development wells was also completed as a Medina gas producer (Nos. 21, 22, Figure 11, Table 10). The other seven wells were Medina gas wells. Of these, 5 are located in the Indian

Spring Pool and 2 in the Kastle Pool. The Burnham No. 1 (No. 14, Figure 11, Table 10) well by James Drilling Co. in Spring Township in the Indian Spring Pool had the largest initial production which amounted to 5000 MCFGPD at a R.P. of 1120 psi in 7 days.

Erie County was the most active county in the Commonwealth during the year. A total of 70 wells were completed. Of these 70 wells, 2 were dry wildcats (Nos. 24, 25, Figure 11, Table 10), 2 were storage wells in the Corry Field, and 66 were Medina gas wells (one, a wildcat, discovery). Of the 66 Medina gas wells, 46 were drilled in the Bushnell Lexington Pool, 18 in the Pierce Pool, 1 in the Lundy's Lane Pool and the wildcat discovered the Dennee Pool. Three wells in the Bushnell Lexington Pool had open flows of 8000 MCFGPD after fracturing (Nos. 47, 61, 83, Figure 11, Table 10). One of the three, the Hartman-Crist No. 1 by Worldwide Petroleum Corp. in Conneaut Township, finished in the Queenston (Upper Ordovician) at 3320 ft. after finding the gas in the Medina. The best well in the Pierce Pool was the R. A. Davidson No. 1 Cayman Corp. in Springfield Township (No. 38, Figure 11, Table 10). After finding the Medina at 2705 ft. the well was completed in the Medina at a total depth of 2806 ft. The well produced 4400 MCFGPDAF at a RP of 950 psi in 12 hrs. The Lundy's Lane development well was the M. & H. Panko by Robert Thorsen in Elk Creek Township (No. 68, Figure 11, Table 10). The well reached a total depth of 3476 ft. in the Medina. It produced 5000 MCFGPDAF at R.P. of 1085 psi in 24 hrs.

The Erie County discovery was made in Venango Township by Consolidated Gas Supply Corp. Blaine Dennee No. 1 well (No. 93, Figure 11, Table 10). The well was drilled to 7465 ft. Basement was found at 7430 ft. The Medina was found containing gas at 3715 ft. After plugging back to 3850 ft. the initial open flow after fracturing was 1061 MCFGPD at a R.P. of 630 psi in 72 hrs. The well discovered the Dennee Pool.

In Fayette County Snee and Eberly et al. drilled J. E. Leonard No. 1 in the Spruell Field (No. 94, Figure 11, Table 10). The Oriskany was found at 7750 ft. and the well completed at a total depth of 7920. After fracturing the well produced 3148 MCFGPD at a R.P. of 3427 psi in 5 days.

Fulton County had three wildcats completed as dry holes during the years in the highly folded Ridge and Valley province. One of the wildcats, Elmer Hill No. 1 (No. 95, Figure 11, Table 10) was drilled by Sun Oil Co. in Brush Creek Township on an anticline in the southeast part of the county. The well reached total depth at 9922 ft. after finding saltwater in the Oriskany at 9895 and 9906 ft. The well was abandoned. Consolidated Gas Supply Corp. drilled wildcat T. E. Nesbitt No. 1 (No. 96, Figure 11, Table 10) in Ayr Township on the McConnellsburg anticline. No

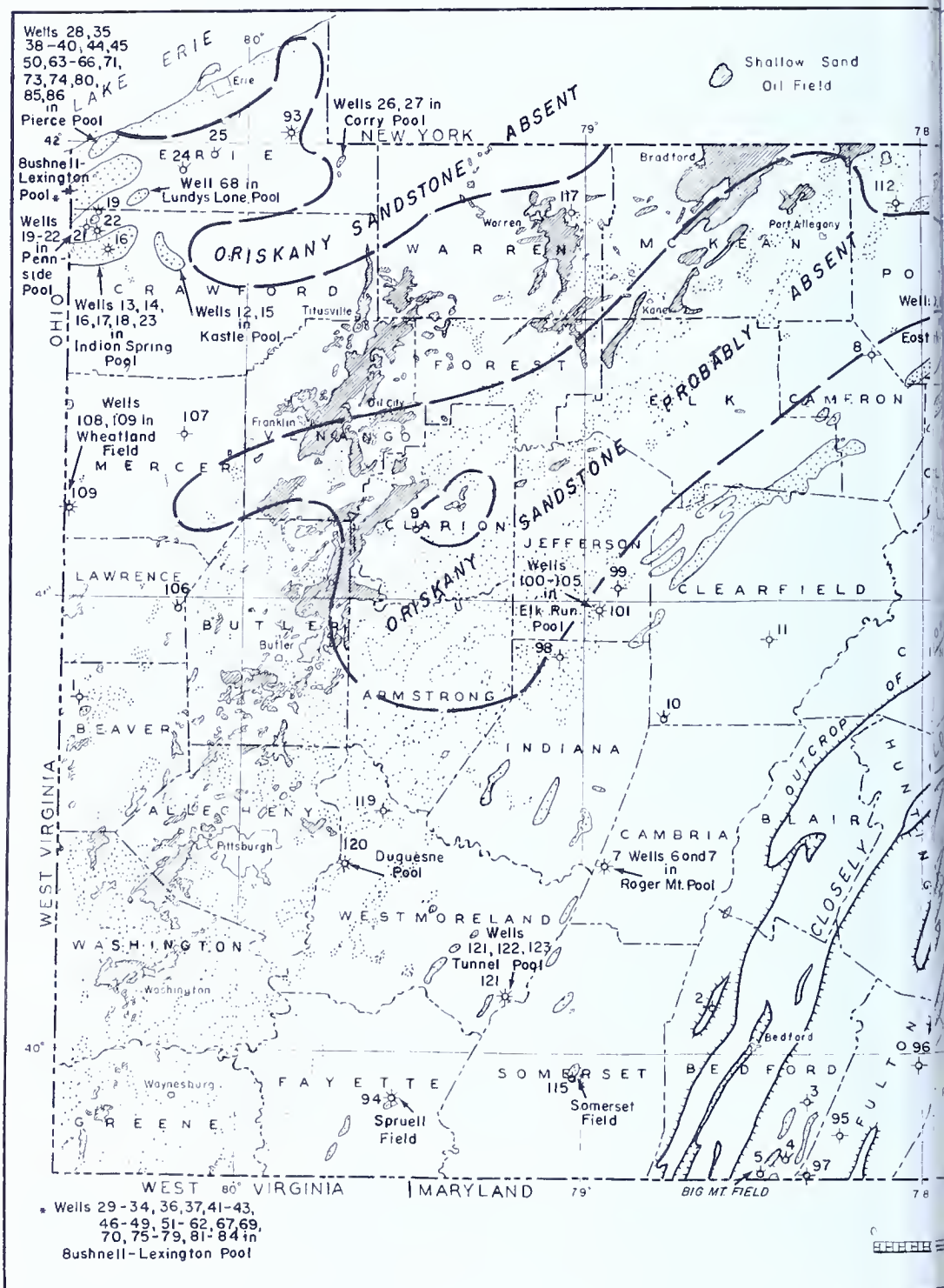
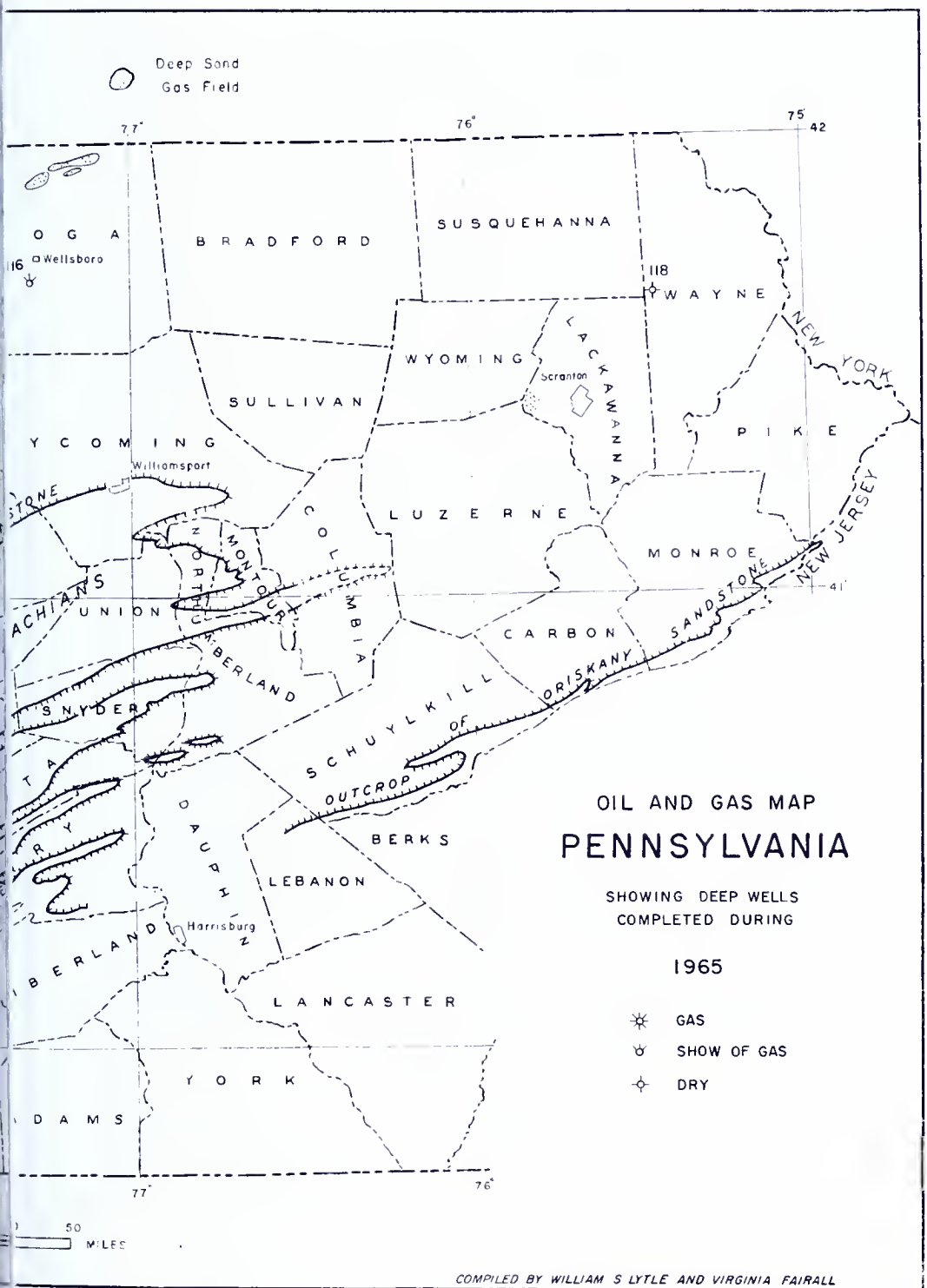

Wells 28, 35 38-40, 44, 45 50, 63-66, 71, 73, 74, 80, 85, 86 in Pierce Pool
Bushnell-Lexington Pool *
Wells 19-22 in Penn-side Pool
Wells 13, 14, 16, 17, 18, 23 in Indion Spring Pool
Wells 12, 15 in Kastle Pool
Well 68 in Lundys Lane Pool
Wells 26, 27 in Corry Pool
Shallow Sand Oil Field
ORISKANY SANDSTONE ABSENT
ORISKANY SANDSTONE PROBABLY ABSENT
CLARION SANDSTONE
ORISKANY OUTCROP CLOSELY FOLLOWS
Wells 108, 109 in Wheatland Field
Wells 100-105 in Elk Run Pool
Wells 7 and 8 in Roger Mt. Pool
Duquesne Pool
Wells 121, 122, 123 Tunnel Pool
Somerset Field
Spruell Field
BIG MT FIELD
ERIE
CRAWFORD
WARREN
MCKEAN
POTTER
FOREST
VENANGO
MERCER
CLARION
JEFFERSON
CAMERON
ELK
CLEARFIELD
LAWRENCE
BUTLER
ARMSTRONG
INDIANA
BEAVER
ALLEGHENY
CAMBRIA
BLAIR
WESTMORELAND
WASHINGTON
FAYETTE
SOMERSET
BEDFORD
GREENE
WEST VIRGINIA
OHIO
NEW YORK
MARYLAND
Erie
Bradford
Warren
Port Allegany
Kane
Titusville
Oil City
Franklin
Butler
Pittsburgh
Washington
Waynesburg
Bedford
* Wells 29-34, 36, 37, 41-43, 46-49, 51-62, 67, 69, 70, 75-79, 81-84 in Bushnell-Lexington Pool

Figure 11. [illegible]


Deep Sand
Gas Field
77°
76°
75°
42
41
O G A
B R A D F O R D
SUSQUEHANNA
Wellsboro
116
118
W A Y N E
WYOMING
Scranton
LACKAWANNA
NEW YORK
SULLIVAN
Y C O M I N G
Williomsport
P I K E
STONE
C O L U M B I A
L U Z E R N E
MONROE
NEW JERSEY
ACHIANS
UNION
CARBON
SANDSTONE
BERLAND
SNYDER
SCHUYLKILL
ORISKANY
OF
OUTCROP
BERKS
LEBANON
Harrisburg
LANCASTER
YORK
DAMS
50
MILES
OIL AND GAS MAP
PENNSYLVANIA
SHOWING DEEP WELLS
COMPLETED DURING
1965
GAS
SHOW OF GAS
DRY
COMPILED BY WILLIAM S LYTLE AND VIRGINIA FAIRALL

ring 1965.

information has been released on this dry wildcat except the total depth of 8648 ft. The third wildcat in the county was the C. E. Flinn No. 1 (No. 97, Figure 11, Table 10) by Manufacturers Light and Heat Company in Union Township on an anticline along the south border of the county. A fault was penetrated and the well was completed in the Hamilton (Middle Devonian) as a dry hole at a total depth of 7313 ft.

Indiana County had a dry wildcat drilled as an updip Oriskany pinchout test along the southeastern edge of the no-sand Oriskany area on the Plumville anticline. This was the Leon H. Hoffman No. 1 well (No. 98, Figure 11, Table 10) by Consolidated Gas Supply Corp. drilled in North Mahoning Township. After finding saltwater in the Oriskany at 7454 ft. the well was drilled to a total depth of 7512 ft. and plugged back to 3643 ft. for shallow gas.

Jefferson County operators drilled seven wells in the county during the year. One was a dry wildcat, one a discovery well and five were development wells. The wildcat well was drilled by New York State Natural Gas Corp. on the R. and P. Coal Co. (Well No. 1) lease (No. 99, Figure 11, Table 10) in McCalmont Township. It was an updip pinchout prospect along the southeast flank of the Sabinsville anticline. After finding the Oriskany dry at 7028 ft. the well was drilled to a total depth of 7137 ft. and plugged back to 5670 ft. for shallow production.

A second wildcat was drilled in the county. This was R. and P. Coal Co. No. 2 (No. 101, Figure 11, Table 10) by Consolidated Gas Supply Corp. in Youngs Township. The well was drilled along the southeastern edge of the no-sand area as an updip pinchout prospect in search of Oriskany production. Gas was found in the Oriskany at 7170 ft. Initial natural production was 2214 MCFGPD at a R.P. of 3960 psi. in 199 hours discovering the Elk Run Pool. By the end of the year five additional development gas wells had been completed and none of them fractured. The largest initial production was 13,385 MCFGPD from the Grover Haag No. 2 well (No. 100, Figure 11, Table 10).

In Laurence County the E. C. Rhodes No. 1 (No. 106, Figure 11, Table 10) was drilled by Peoples Natural Gas Co. in Slippery Rock Township in the Homewood anticline. After fracturing the Oriskany which was found at 4688 ft. the well produced 105 MCFGPD at a R.P. of 600 psi in 7 hrs. The well was abandoned.

Mercer County had three wells completed within its borders. The R. W. Temple No. 1 (No. 107, Figure 11, Table 10) by Peoples Natural Gas Co. was drilled in Lake Township to the Precambrian. A show of gas and saltwater was found at 8512, the Precambrian at 9811 and the total depth at 9919. The well was abandoned. Two development gas

wells were drilled in the Wheatland Field by William C. Vandenberg, Jr. As yet no report has been received on Chadderton Services Inc. No. 1 well. The second well, S. and A. Laudo No. 1 (No. 109, Figure 11, Table 10) found the Medina at 4890 ft. and was completed at a total depth of 5013 ft. The initial open flow after fracturing was 1200 MCFGPD at a R.P. of 1235 psi.

The deep drilling in Potter County amounted to one dry wildcat and four gas storage wells. The wildcat was the Baird Tuller No. 7 (No. 112, Figure 11, Table 10) by Chet Wharton in Hebron Township west of the Hebron Gas Storage Pool. The well was an old shallow well drilled deeper to a final total depth of 5755 ft. after finding saltwater in the Oriskany at 5748 ft. The well was abandoned. The four gas storage wells were drilled in Wharton Township in the East Fork-Wharton Gas Storage Field by United Natural Gas Co.

Somerset County had one development well. The John W. Swith No. 1 (No. 115, Figure 11, Table 10) was drilled by Shell Oil Co. in Brothers Valley Township in the Somerset Gas Field on the Negro Mountain anticline. The Oriskany at 8837 ft. had a show of gas and some saltwater after fracturing. The well was abandoned.

In Tioga County City Service Oil Co. drilled F. Cobb, et al. No. 1 (No. 116, Figure 11, Table 10) in Delmar Township on the southeastern flank of the Wellsboro anticline. The Oriskany at 5385 ft. had a show of gas in it after fracturing. The wildcat was abandoned at a total depth of 5480 ft.

The Warren County wildcat Mead 30 (No. 117, Figure 11, Table 10) by Pennzoil Co. was drilled in Mead Township. The Oriskany was found dry at 4620 ft. and the well was plugged and abandoned at a total depth of 4718 ft.

A wildcat in Wayne County, the Hudson Realty Corp. No. 1 (No. 118, Figure 11, Table 10) by Humble Oil and Refining Co. was abandoned in the Upper Devonian after drilling 7443 ft.

Westmoreland County had three wildcats and two development wells. Two of the wildcats were drilled on the Murrysville anticline. One wildcat, the George J. Sloan No. 1 (No. 119, Figure 11, Table 10) by Peoples Natural Gas Co. et al. found the Oriskany at 7252 containing saltwater. The well was abandoned. The other Murrysville anticline wildcat discovered the Duquesne Pool. This discovery was the Duquesne Gas Co. No. 1 (No. 120, Figure 11, Table 10) by Fox, Coen and Sloan in Franklin Township. The Oriskany at 7701 ft. produced 1200 MCFGPD after fracturing at a R.P. of 3832 psi in 24 hrs. A wildcat on the Laurel Hill anticline, the J. S. Blair No. 4 (No. 121, Figure 11, Table 10) dis-

covered the Tunnel Pool in Cook Township. The Oriskany was found at 8340 ft. It produced 11,000 MCFGPD after fracturing at a R.P. of 2722 psi in 24 hrs. By the years end two more development wells were drilled in this pool but they both had shows of gas and saltwater and were abandoned.

REPORTS ON SELECTED DEEP GAS POOLS

DRY RIDGE POOL

BY JOSEPH H. GOTH, JR.

In September, 1946, American Locomotive Company completed the No. 1 L. C. Steiner in the Dry Ridge Pool in Westmoreland County for 134,000 CFGPD natural from the Oriskany Sandstone at a depth of 8006 to 8009 feet. The Dry Ridge Pool now produces gas from both the Onondaga Chert and the Oriskany Sandstone, and is structurally situated on a faulted anticline. Production to date has been limited to the central and west faulted blocks.

Two high angle reverse faults, parallel to the anticlinal axis are present, with closure to the east and west being associated with the fault pattern.

To date seven deep completions have been made in the pool (Figure 12), along with one well completed from Upper Devonian sands. One well was plugged and abandoned in 1955 (No. 1 J. A. Mills), and the remaining producers were drilled in 1963 and 1964.

Average initial open flow potential after fracture treatment was 6,010,000 CFGPD. Average initial rock pressure was 4135 psi while the average depth to the top of the Oriskany sandstone was 7742 feet.

THE KASTLE MEDINA GAS FIELD, CRAWFORD COUNTY

BY DANA R. KELLEY

The Kastle Lower Silurian Medina gas pool in central Crawford County has been continuously exploited since discovery in 1962. The discovery well, Transamerican #1 Kastle (Meadville A quad., Well #3, Hayfield Township, Crawford County), a 4315-foot upper Queenston (Ordovician) wildcat, was completed as a shut-in gas well on October 1, 1962 for a reported calculated open flow of 1500 MCFGPD and rock pressure of 1060 psi/12 hours through hydrofrac perforations at 4198 ft. in the Grimsby Sand. Since discovery, one additional completion was made in 1962, 13 completions in 1963, 34 completions in 1964, and 1

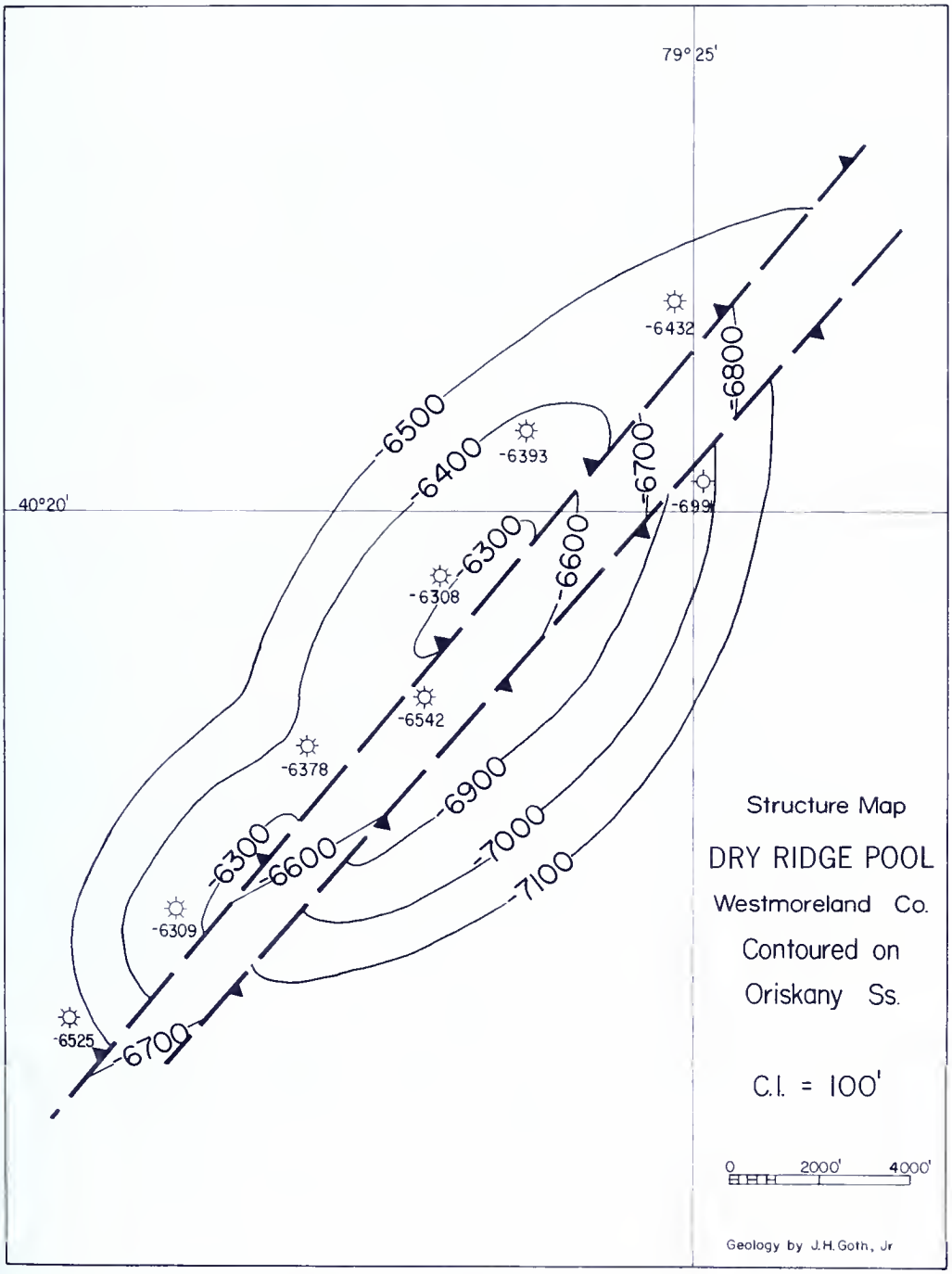
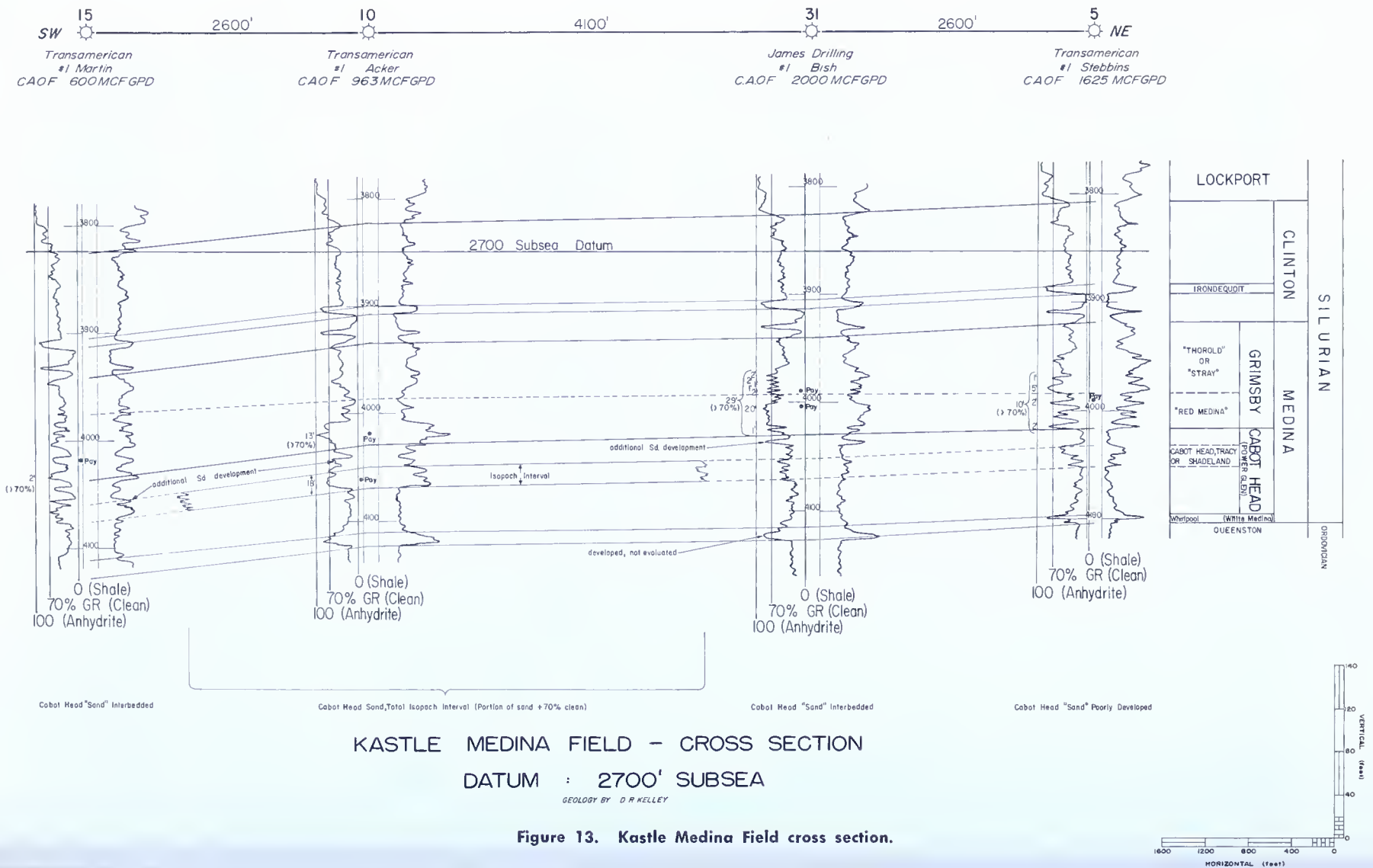


Figure 12. Dry Ridge Oriskany Gas Pool.

completion in 1965, for a total of 50 producing field wells. Two new locations have been reported this year. There are five dry holes within a mile of the field limits, all drilled in 1963. The field went on line production in early 1965.



KASTLE MEDINA FIELD – CROSS SECTION

DATUM : 2700' SUBSEA

GEOLOGY BY D.P. KELLEY

Figure 13. Kastle Medina Field cross section.

The purpose of this progress report is to briefly describe this new field, with particular emphasis on reservoir distribution and the nature of the hydrocarbon trap; and to present some suggestions that may aid and stimulate further industry exploration and development for Medina gas reserves in Pennsylvania. Principles of reservoir development and fluid entrapment are basically the same as in other nearby large Medina fields, and applicable to general Medina exploration and development elsewhere in the State.

The Kastle Field is located in central Crawford County, in northwest Pennsylvania, on stratigraphic trend 1¼ miles southeast of the edge of the Indian Springs Medina Gas Field. The center of the field is located approximately at the common corners of Meadville (A), Linesville (C), Cambridge Springs (G), and Girard (I) quadrangles.

General Lithology and Structures

The Medina is a lower Silurian clastic section characterized by interbedded fine-grained sandstone, varying amounts of red, green, and gray shales, and minor amounts of thin shaly or silty dolomites. Thickness ranges from 170-250 feet, and the formation is encountered between 3800 and 4500 feet in depth. Various names have been applied to the major sand intervals and separating shale units (Figure 13). The Medina rests disconformably on the Ordovician Queenston red clastics, and is overlain conformably by the Silurian Clinton interbedded dark shales, carbonates, and occasional sandstones. For the purpose of this progress report the Medina has been divided into upper Grimsby predominantly sandy interval, middle Cabot Head predominantly shale interval, and a basal Whirlpool sandstone. Reservoir sandstones develop in the lower portion of the Grimsby and the upper portion of the Cabot Head intervals.

There are no significant local changes in thickness in the Medina or its members in the field area. The Grimsby, for example, ranges only in thickness from 80 to 105 feet in the entire mapped area. Gradual thickening in this member generally occurs to the south. Within the various members of the Medina, rapid local changes in sandstone development occur.

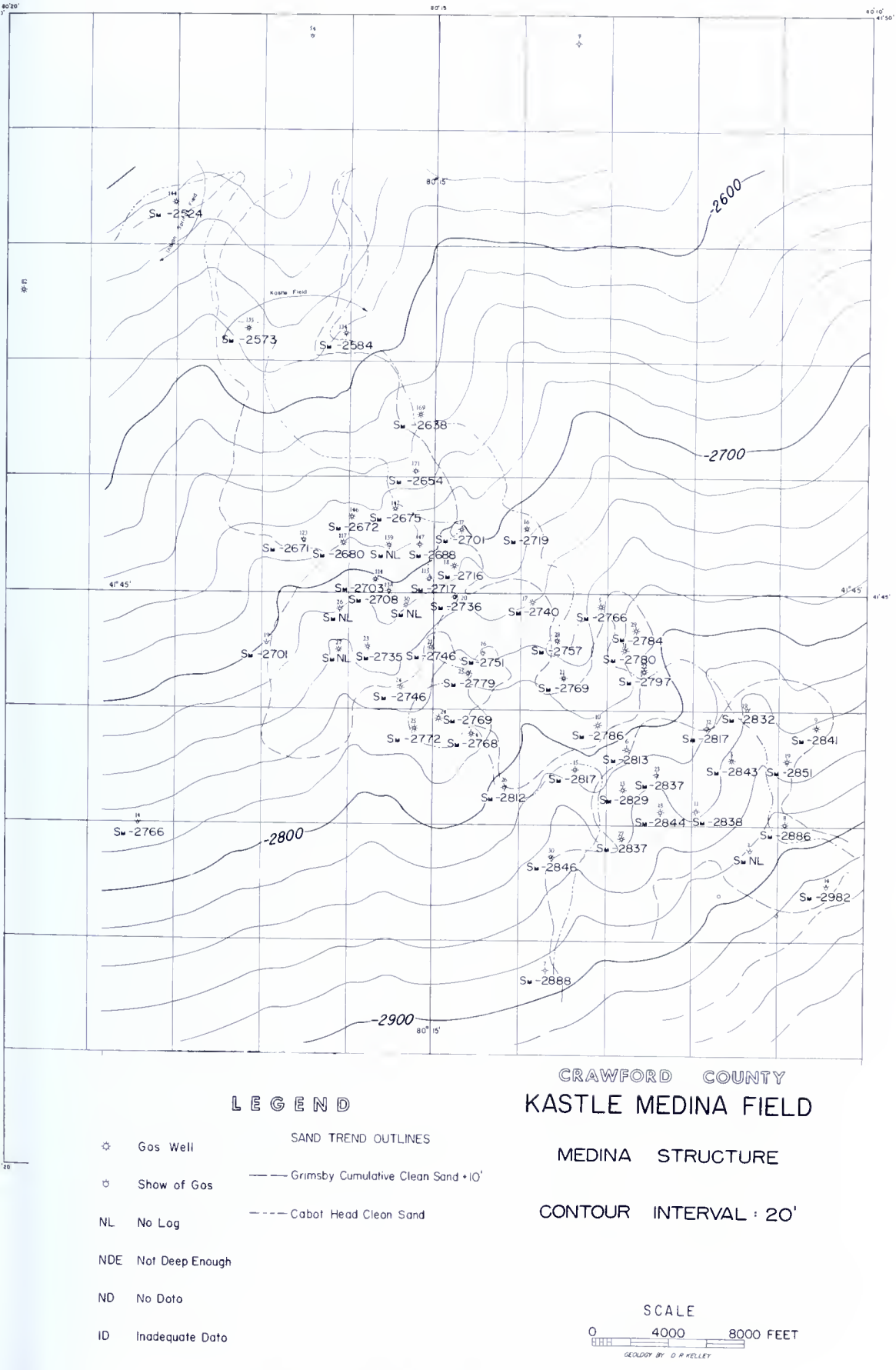
Structure on top of the Medina portrays relatively uniform regional dip of between 60 and 70 feet per mile to the south-southeast (Figure 14). Southeastward-plunging nosing within the field area may, or may not, be significant. Lack of appreciable subsurface control outside of the field makes it impossible to determine whether gentle warping of regional dip is characteristic at this horizon over broad areas, or occurs locally associated with fields. There have been some reports that many of the

Medina fields are associated with anomalous nosing in regional dip, particularly where seismic control is available to ascertain structure outside of the drilled areas. If this is the case, lack of appreciable local thickening, and therefore similar structure on the Queenston, implies weak post-Medina deformation at sites of selective Medina sand deposition. Should a field structural relationship be demonstrated, it may be that the edge of the basin along which localization of Medina sands occurred was also a zone of weakness along which later structural adjustment preferentially took place.

Medina Pay Sandstones

Reasonable geological mapping criteria can be established for the Kastle Field, as they can for most fields, with reported initial potentials or production and geophysical log parameters. Using a general cost of $10.00 per foot for a completed well (it may be as low as $9.00 per foot for some operations in the Kastle Field), 10 percent deliverable production, and $0.25 per MCF price of gas, it would take five years or more for a 1 MMCFGPD well to make pay out and slight profit should no decline in production occur, and excluding such variable, but important, factors as overhead, interest, taxes, and gas demand fluctuations, etc. Although a 1 MMCFGPD economic I. P. cut-off may be optimistic, it was used in establishing mappable log parameters in the Kastle Field. A word of caution is noted here. Initial production figures at best leave much to be desired pertinent to the economic potential of a well. In Pennsylvania, which is different from many other producing states, there may be considerable question as to the usefulness of even this index of economic potential, inasmuch as there is no required minimum standards of completion methods, and generally four point gauges are not taken in gas wells. However, there seldom is anything else to use in expressing the quality of a well or field. Reporting of accurate well or lease production figures is not required, and available production figures are at best incomplete or too generalized to use.

The gamma-ray log measures amounts of natural radioactive elements in the bore hole, and for all practical purposes, these elements are generally concentrated in shale as compared with the other common sedimentary rock types. It is well known that shaliness of a pay section, either clastic or carbonate, greatly restricts fluid migration, mostly through interstitial pore clogging, other factors being equal. A cursory statistical examination revealed that a majority of wells having initial potentials in the vicinity of 1 MMCFGPD or less were characterized by pay sandstone 70 percent or less gamma-ray "clean" (or shale free), therefore only Medina sandstones 70 percent or more gamma-ray "clean"



CRAWFORD COUNTY

KASTLE MEDINA FIELD

MEDINA STRUCTURE

CONTOUR INTERVAL : 20'

LEGEND

- Gos Well
- Show of Gos
- NL No Log
- NDE Not Deep Enough
- ND No Data
- ID Inadequate Data

SAND TREND OUTLINES

- Grimsby Cumulative Clean Sand +10'
- Cabot Head Clean Sand

SCALE

0 4000 8000 FEET

GEOLOGY BY D R KELLEY

Figure 14. Kastle Medina Field structure map.

(shale free) were mapped. The 70 percent gamma-ray "clean" line was established for each well log by using an average maximum anhydrite or clean carbonate as relative zero natural radioactivity (essentially no shale), and an average maximum shale as relative 100 percent natural radioactivity. (Figure 13). Use of direct API measurements on standardized logs is not sufficiently accurate for mapping. Other geologists working in the Medina use from 55 to 65 percent gamma-ray "clean" cutoffs, depending on the economic limits desired. A less limited gamma-ray cutoff than 70 percent will result in a broader sand trend with somewhat less definition of productive limits.

Productive Grimsby Sandstones—The greatest production in the Kastle Field comes from thin sandstones most frequently occurring in the lower portion of the Grimsby interval, the operator's "Red Medina" (Figure 13). From one to as many as nine separate sandstones may be developed in a well. The thickness of a 70 percent gamma-ray clean sandstone ranges from 1 to 22 feet. Although specific sandstone beds can be mapped between a few wells, the rapidity with which they grade laterally into shaly sandstones, siltstones, and shales makes it difficult to establish widespread accurate correlations for all of the individual sands. For this reason the cumulative isopach of pay sandstones (70 percent gamma-ray clean) in the Grimsby interval best illustrates the distribution of Grimsby productive reservoir zones (Figure 15). Cumulative clean sandstones occur in a northwest-trending belt from 2 to approximately 4 miles wide. Where there is sufficient control within the belt, there are cross-trending "pods" of maximum sand development. The better producing wells are generally associated with these pods. Analysis of geophysical log data indicates porosity in the range of 5 to 18 percent bulk volume, with the thicker pay sandstones having greater porosity. Both the thicker individual beds and the greater number of pay sands occur associated with the cross-trending pods of maximum cumulative clean sand thickness. A cursory examination of the few samples available in the field indicates the average pay sandstones are white to light gray and contain 90 percent or better subrounded to subangular, moderate sphericity, fine-to-medium-grained quartz with minor accessory detrital grains, and 10 percent or less clay-silica, and/or dolomitic cement. Increased coarseness of quartz, and a decrease in the amount of cement, accompanies better log-developed sands. Conversely, the more poorly log-developed sands contain finer quartz and more cementing material. Laterally equivalent very fine- to fine-grained sandstones, siltstones, and shales can be either red, gray-green, or gray-colored; they may contain glauconite, and in some cases dolomitic cement, particularly in the upper portion of the productive Grimsby interval. Detailed petrography of the sandstones has not been made. Such a study is warranted and would produce important results,

particularly with regard to the effect the clay and dolomitic cements have in well stimulation and subsequent secondary recovery methods that could be applied.

Productive Cabot Head Sandstone.—Approximately seven wells are believed to be productive from a sandstone that develops in the upper portion of the Cabot Head interval (Figure 13). A total isopach of this sandstone was made whenever a portion of the sandstone indicated sufficient shale-free characteristics to be considered economically productive (70 percent gamma-ray clean). The pay sandstone grades laterally into a shaly sandstone which becomes interbedded with gray shale, and in turn finally grades into gray siltstone and shales. Figure 16 illustrates a northwest-trending narrow belt of sand deposition, 1 to 2 miles wide, roughly underlying the Grimsby sand trend. Localized areas of maximum thickness of sand do not have the cross-trending relationship to the over-all belt of sand development noticed for the Grimsby. The Cabot Head sandstone ranges in total thickness from 1 to 18 feet. Net clean pay sand thickness ranges from 1 to 11 feet. The description of this sandstone, and development of porosity, is similar to that discussed for the Grimsby above. Not all wells have evaluated the Cabot Head sand development trend; the total depth for some of the field wells being in the upper Cabot Head shale.

Whirlpool Sandstone.—The lower Medina Whirlpool sandstone does not obtain maximum development comparable to the Grimsby or Cabot Head pay sandstones; consequently, this unit was not mapped. Total thickness of the Whirlpool is generally less than 15 feet. However, in a few wells the presence of a relatively shale-free sandstone containing log porosity suggests that fluid evaluation of this zone was warranted (Figure 13). There is no production from the Whirlpool in the Kastle Field and no tests have been taken. Many wells in the field have not drilled through this basal Medina sandstone. Although the prospects for obtaining significant production from the Whirlpool appears limited because of the thinness of potential pay section, the absence of conclusive fluid evaluation necessitates placing the Whirlpool in the category of an unevaluated secondary pay sand in the field.

Possible Genesis of Medina Reservoir Zones.—A comparable appraisal of other Medina fields, along with concurrent regional Lower Silurian studies and petrographic examinations are needed before well-founded conclusions regarding the genesis of the productive pay sands can be made. However, the distinctive pattern of distribution of pay sands in the Kastle Field in the context of previous published studies of Lower Silurian rocks in the Appalachian Basin warrants some comment.

The Kastle Field, and most other major Medina fields immediately

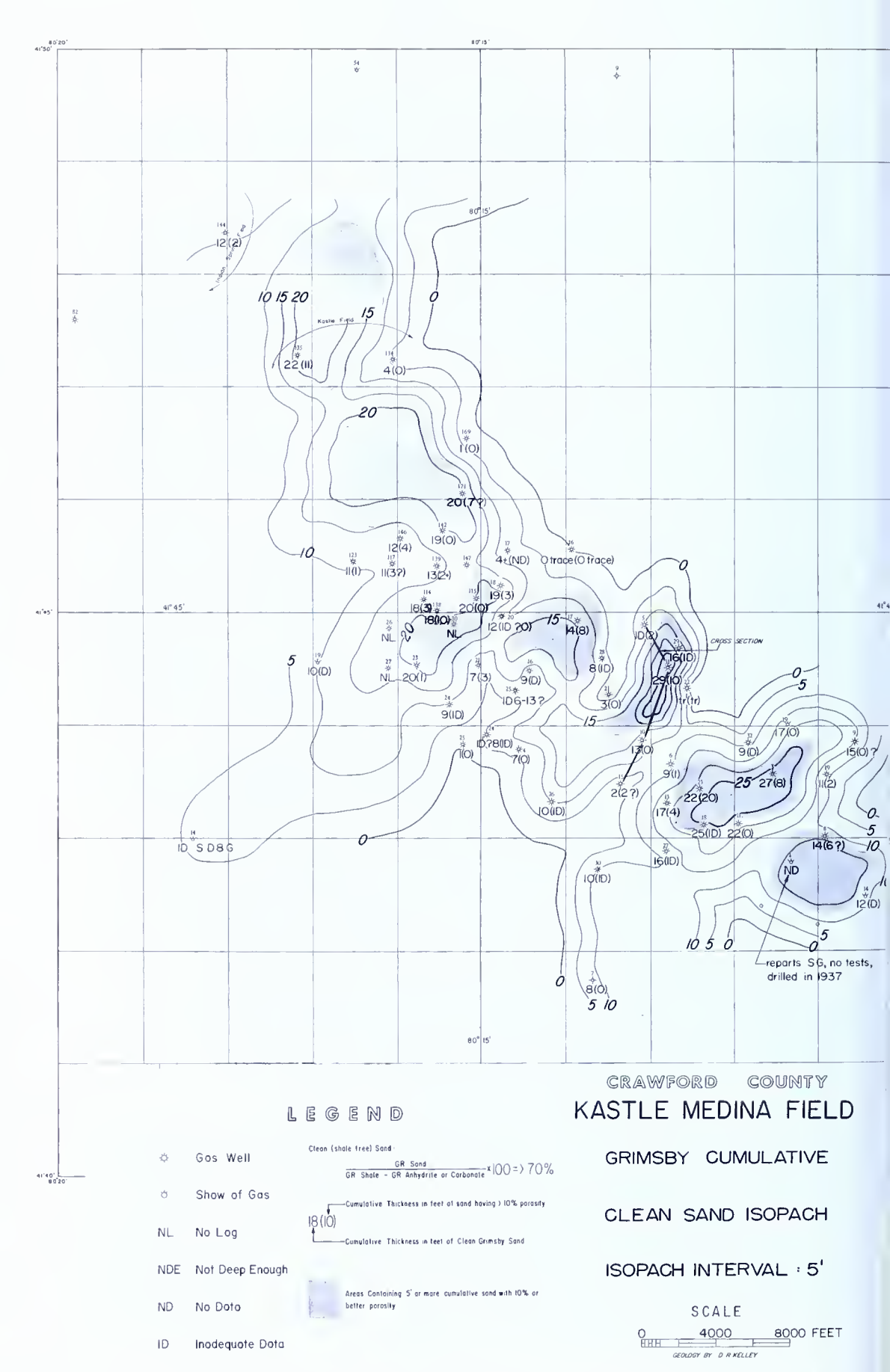
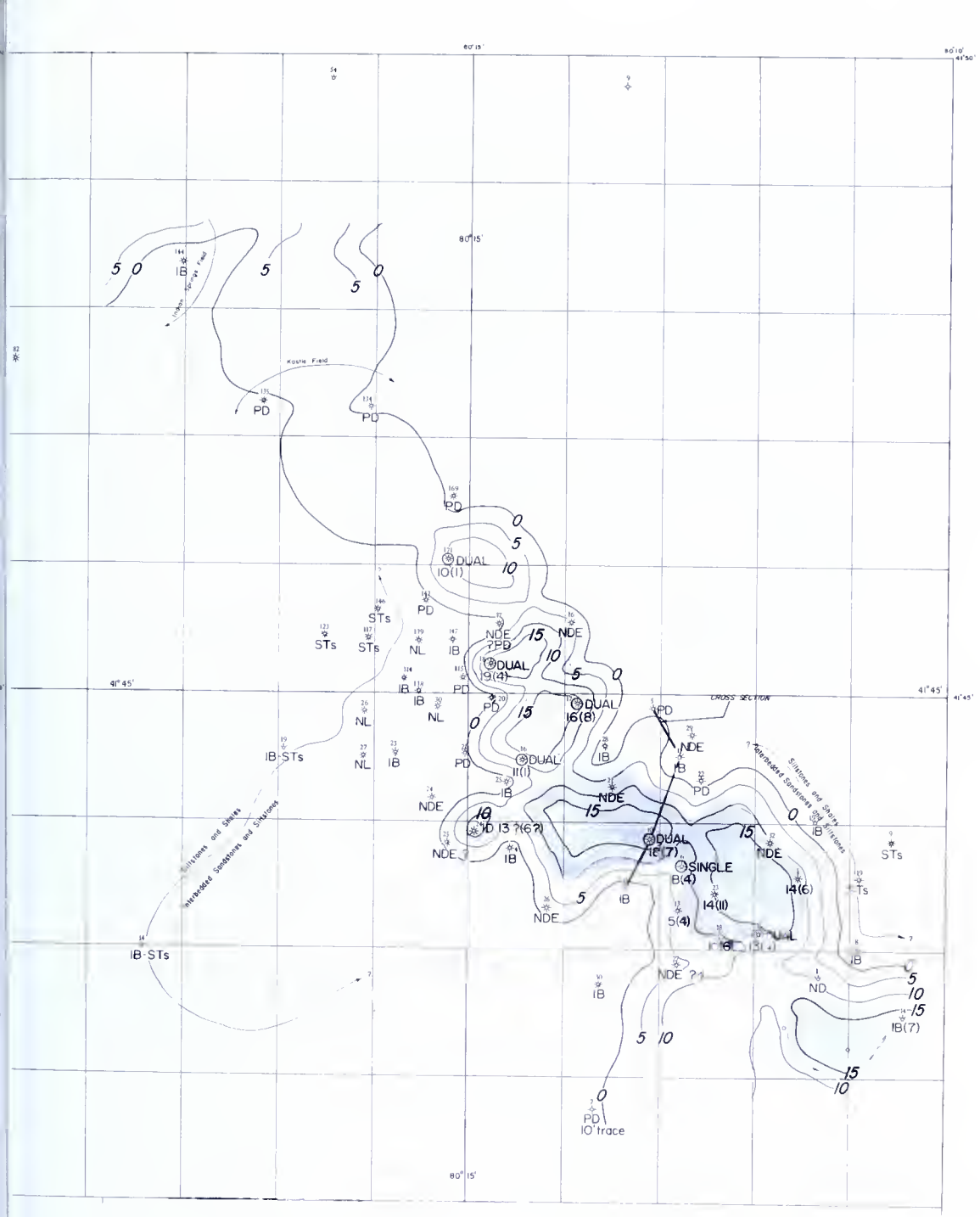


Figure 15. Kastle Medina Field showing Grimsby cumulative clean sand isopach lines.



CRAWFORD COUNTY

KASTLE MEDINA FIELD

CABOT HEAD CLEAN SAND

TOTAL ISOPACH

ISOPACH INTERVAL : 5'

SCALE

0 4000 8000 FEET

GEOLOGY BY D. R. KELLEY

LEGEND

☼ Gas Well

☼ Show of Gas

NL No Log

NDE Not Deep Enough

ND No Data

ID Inadequate Data

STs Siltstones & Shales

Clean (shale free) Sand

$$\frac{\text{GR Sand}}{\text{GR Shale} - \text{GR Anhydrite or Carbonate}} \times 100 = \text{) } 70\%$$

18 (10) — Cumulative Thickness in feet of Clean Sand; Total Thickness in feet of Cabot Head Sand where portion of sand is clean

Areas Containing 5' or more Clean Sand

PD Poorly Developed, clean sand < 70%

IB Interbedded Sands, Siltstones & Shales

Figure 16. Kastle Medina Field showing Cabot Head total isopach lines.

to the northwest, are located along the eastern shelf edge of the Appalachian Basin, a shallow epicontinental sea during early Silurian time (Rittenhouse, 1949; Amsden, 1955). The source of clastics was to the southeast in southeastern Pennsylvania, where streams draining the source area flowed northwesterly across the fall line into the basin at relatively distinct debouching points (Yeakel, 1962). The general northwesterly trend of sandstone development in the Kastle Field locally parallels the interpreted shore line trend of this early Silurian sea (Figure 17). Similar

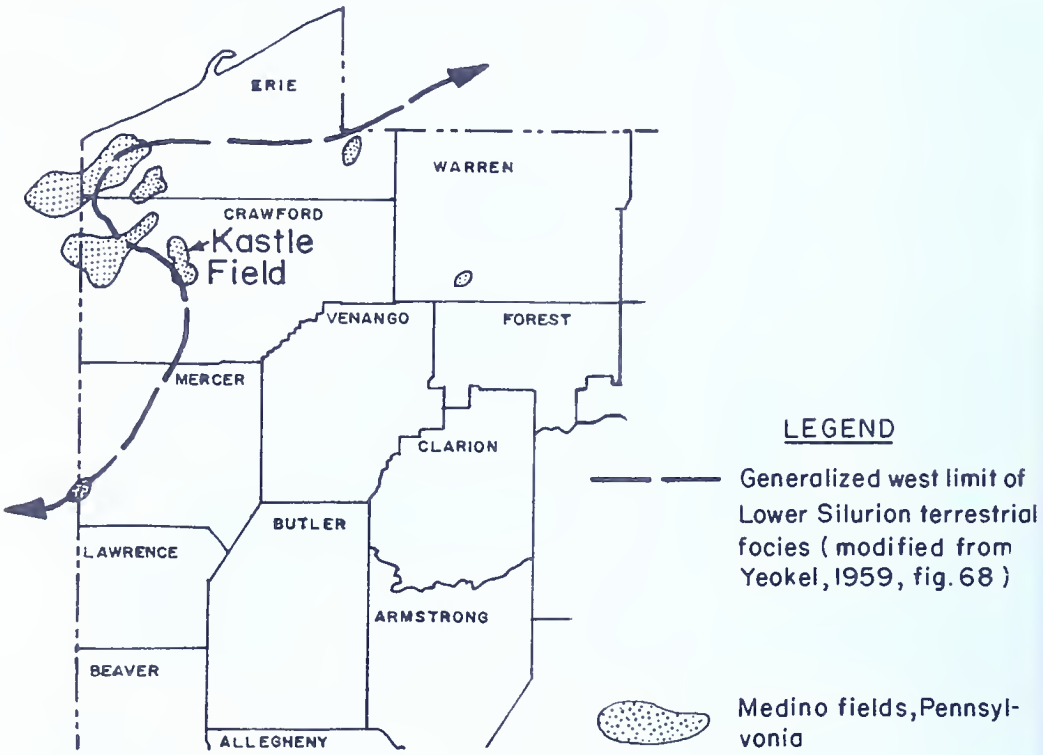


Figure 17. Index map of western Pennsylvania showing Medina fields and trend of early Silurian shoreline.

to the correlative "Clinton" sands of Ohio (Pepper and others, 1953), the lenses of thicker Grimsby sands form narrow westward cross trends reflective of channel deposits. The cross-trending relationship of maximum Grimsby sand development, multiple thin sandstones, presence of laterally equivalent red and green fine clastics, and a less definable shoreline trend suggest a shallow marine or littoral environment, most likely a shore-line beach and/or delta front complex, where distribution of the more porous reservoir zones was influenced by a combination of along-shore marine and intruding stream-derived currents. The Cabot Head sandstone thicknesses exhibit little secondary cross trends. The narrow width of the isopach belt, rapid lateral change in facies into gray marine shales and siltstones suggest an environment of deposition

more basinward than the overlying Grimsby. Possibly the Cabot Head sand represents an offshore bar where the coarser clastics preferentially settled and were distributed along the edge of the basin.

Considerable exploration and development value would attend a combined local, regional, and petrographic study of the Lower Silurian section. Through such a study it should be possible to delineate major fluviatile distributary trends and likely debauching areas where intersection and commingling with littoral zone deposition could afford significant accumulations of reservoir sands. Such studies would also be important in more closely detailing the transgressive and regressive fluctuations, or where the operator could anticipate these near shore sand deposits to occur for the various Medina sand units.

Completion and Production

Wells in the Kastle Field are drilled with air (essentially a foam from Oriskany to total depth). In most wells 4½-inch casing is run and cemented at total depth, and 1½-inch tubing is used for completion. In general, all prospective sand stringers are perforated through casing and simultaneously hydrofraced. Consequently, it is difficult to appraise the potential of specific sands, and there is no way to fully evaluate the relative productive capability of the Cabot Head sandstone which is, in all but one well, dually completed with the Grimsby. Some operators are considering separate evaluation of the prospective sand zones through a modified limited entry treatment in subsequent completions.

Following are summarized reported completion data:

Depth to Medina pay: 3800-4500 feet.	
Number of perforated intervals per well:	1 to 4, average 2.
Amount of pay perforated per well (feet):	1 to 81 (1 open hole), average 12 feet.
Net pay per single sand, per well (feet):	1 to 22, average 6.
Hydrofrac treatment # Sd:	4,000 to 100,000, average 47,500.
B Wtr:	412 to 1364, average 735.
Other (some wells):	nitrogen, mud acid, walnut hulls, prop. balls, additives.
Breakdown pressure, lbs/in²:	1400 to 4100.
Initial Potential, CAOF in MCFGPD:	100 to 15,000, average 1900.
BOPD:	all wells sbme, up to 50.
BWPD:	all wells some, amount unknown.
Rock pressure, lbs/in²:	635 to 1280.

The Kastle Field was put on production in February-March 1965. A reported estimate of average monthly production for 20 of the field wells is 105 MMCFG, approximately 7½ percent of the capability indicated by initial potential. In some wells significant amounts of oil are being produced. The Transamerican No. 1 Miller (Linesville C, Well #27) is

essentially an oil well having been completed for 50 BOPD and 300 MCFGPD. It is reported to be producing approximately 12 BOPD, 150 MCFGPD, and some water. It is our understanding that all wells produce some connate water. Useful analytical data on oil and water have not been obtained. It is not known at this time whether any special conservation procedures have been, or are being, initiated to insure recovery of maximum reserves by current primary or possible future secondary recovery methods.

Examination of available data suggests the following general lithologic parameters can be tentatively established relative to production:

	Probable IP <1 MMCFGPD	Variable IP ± 1 MMCFGPD	Probable IP >1 MMCFGPD
Log porosity (% bulk volume):	–7	7–15	+15
Single bed thickness (feet of clean sand):	–4	4–10	+10
Grimsby cumulative clean sand thickness (necessary to anticipate desired porosity and single bed thickness, in feet):	–10	10–25	+25

In Pennsylvania there are no requirements for well spacing. In the Kastle Field, wells have been drilled as close as 2,000 feet apart, and spacing would range from 320 to 80 acres per well. However, the distribution suggests an attempt to maintain approximately 160 acres per well.

Field Classification and Limits

The Kastle Field is basically a gas-expansion-drive, stratigraphic trap with an up-dip (north and easterly) limit formed by a permeability barrier caused by pay sand shale-out, and possible to a lesser degree pinch-out. The down-dip (south and westerly) limit appears to be similarly a permeability barrier caused by pay sand shale-out. There is not enough data to determine whether indistinct gas-oil, gas-water, or oil-water contacts exist, such as are present in many relatively tight sand fields. Reported water-bearing porous Medina sands bounding production in other fields up-dip to the northwest suggest that segregation of fluids may occur in some of the larger Medina reservoirs, and consequently structure may in part define the down-dip limits of some Medina fields. Considering the distribution of maximum sand developments indicated in the Kastle Field, it is probable that permeability barriers exist along stratigraphic strike within the general shelf-edge sand trends, forming separate hydrocarbon reservoirs, some water-bearing, some not. Improved quality and quantity of data regarding fluid recoveries from the Medina may, upon analysis, reveal significant relationships useful in establishing reservoir proximity indicators, as well as field limits.

The lateral limits of the Kastle Field are not clearly defined. Production along the northwest edge of the Kastle Field is only 1¼ miles southeast of the limits of the Indian Springs Medina Field. There is reason to infer that the two fields will be connected by further development. Although wells along the southeast edge of the field are slightly below average producers by initial potential, there is no evidence to define a field limit in this direction. The Potter Development No. 1 Dahl, 4522-foot Queenston dry hole (Meadville "A", Well #1) was drilled in 1937. Shows of gas at 4291 ft. in the Medina were not tested. It is our understanding that the presence of a Medina show in this well stimulated the drilling of the discovery wildcat in the Kastle Field.

An evaluation of post-Medina prospective horizons was not made in this progress field report. Water has been reported in the Devonian Onondaga and Oriskany, and in the Silurian Bass Island-Salina, and Lockport horizons in most wells in which shows have been recorded in and bounding the Kastle Field. However, of interest, the following reports of post-Medina hydrocarbon occurrences not further evaluated by testing are herewith listed:

ONONDAGA

1. Ventura No. 1 Lybarger, Meadville A, Well #26, show of gas.

ORISKANY

1. Ann No. 1 Atwood, Girard 1, Well #82, Indian Springs Field, just west of mapped area, show of water and possibly gas.
2. Ventura No. 1 Tautin, Girard 1, Well #171, 2 MMCFGPD blew down, no report of water.
3. Atlas No. 1 Gosick, Cambridge Springs, Well #8, just north of mapped area, Salina dry hole, 2500 MCFGPD, no water, perforated and fraced into salt water before casing collapsed.

LOCKPORT

1. Ann No. 1 Atwood, Girard 1, Well #82, Indiana Springs Field, just west of mapped area, show gas 3560′ (–2343′), show water 3573′ (–2358′).
2. Potter No. 1 Dahl, Meadville A, Well #1, show of gas and water 4016′ (–2671′).
3. Transamerican No. 1 Kastle, Meadville A, Well #3, show of gas and water.
4. Atlas No. 1 Revak, Cambridge Springs G, Well #9, just north of mapped area, 200 MCFGPD natural at 3505′ (–2262′) to 3515′, show of gas and water 3600′ (–2357′) to 3614′. Some feel a completion could have been made in the Lockport.

Some of these occurrences are believed to warrant additional investigation.

Selected References

Amsden, T. W. (1955), *Lithofacies map of lower Silurian deposits in central and eastern United States and Canada,* Am. Assoc. Petroleum Geologists Bull., v. 39, no. 1, p. 60-74.

Pepper, J. F. and others (1953), *"Clinton" sands in Canton, Dover, Massillon, and Navarre quadrangles, Ohio,* U. S. Geol. Survey Bull. 1003-A, 15 p.

Rittenhouse, Gordon (1949), *Early Silurian rocks of the northern Appalachian Basin,* U. S. Geol. Survey Oil and Gas Inv. (Prelim.) Map 100.

Yeakel, L. S. (1962), *Tuscarora, Juniata, and Bald Eagle paleocurrents and paleogeography in the central Appalachians,* Geol. Soc. America Bull., v. 73, no 12, p. 1515-1540.

BEDFORD COUNTY ORISKANY (RIDGELEY) GAS FIELDS

BY WALTER R. WAGNER

Production from the Oriskany (Ridgeley) gas fields in Bedford County is the only hydrocarbon production from the Valley and Ridge province in Pennsylvania. The gas was first discovered in the Purcell Field in 1957 and the structure and stratigraphy of that field have been discussed by Cate (1963a, 1963b) and need not be repeated here. Since the discovery of the Purcell Field, three new gas fields and one new gas pool have been found in southeastern Bedford County. They are the Five Forks (1962), Artemas (1963), Big Mountain (1964) Fields and the Pennland Pool (1964). The location of the new fields and pool is shown in the index map of Figure 18.

The gas fields are situated on thrust-faulted anticlines within the Broad Top synclinorium. The strike of the thrusts and the folds generally parallels the northeast-southwest Appalachian grain. Most of the faults appear to dip to the southeast at angles of 60 degrees or more. Boundaries of the gas fields are often controlled on the northwest and southeast by the faults and on the northeast and southwest by the plunge of the anticlines.

Every well drilled in the area crosses at least one thrust fault and in most of the wells three and sometimes four faults are encountered. The amount and intensity of faulting is greatest just above the Ridgeley Sandstone, in the Onondaga Limestone and in the dark shales above the Onondaga. Below the Ridgeley the nature of the faulting is not known. Above the Middle Devonian Clearville Sandstone the faulting diminishes and is much less evident in the Upper Devonian rocks exposed at the surface.

The dip of the strata, except at the anticlinal crests, is moderate to steep. When wells were first drilled in the Purcell Field, difficulty was

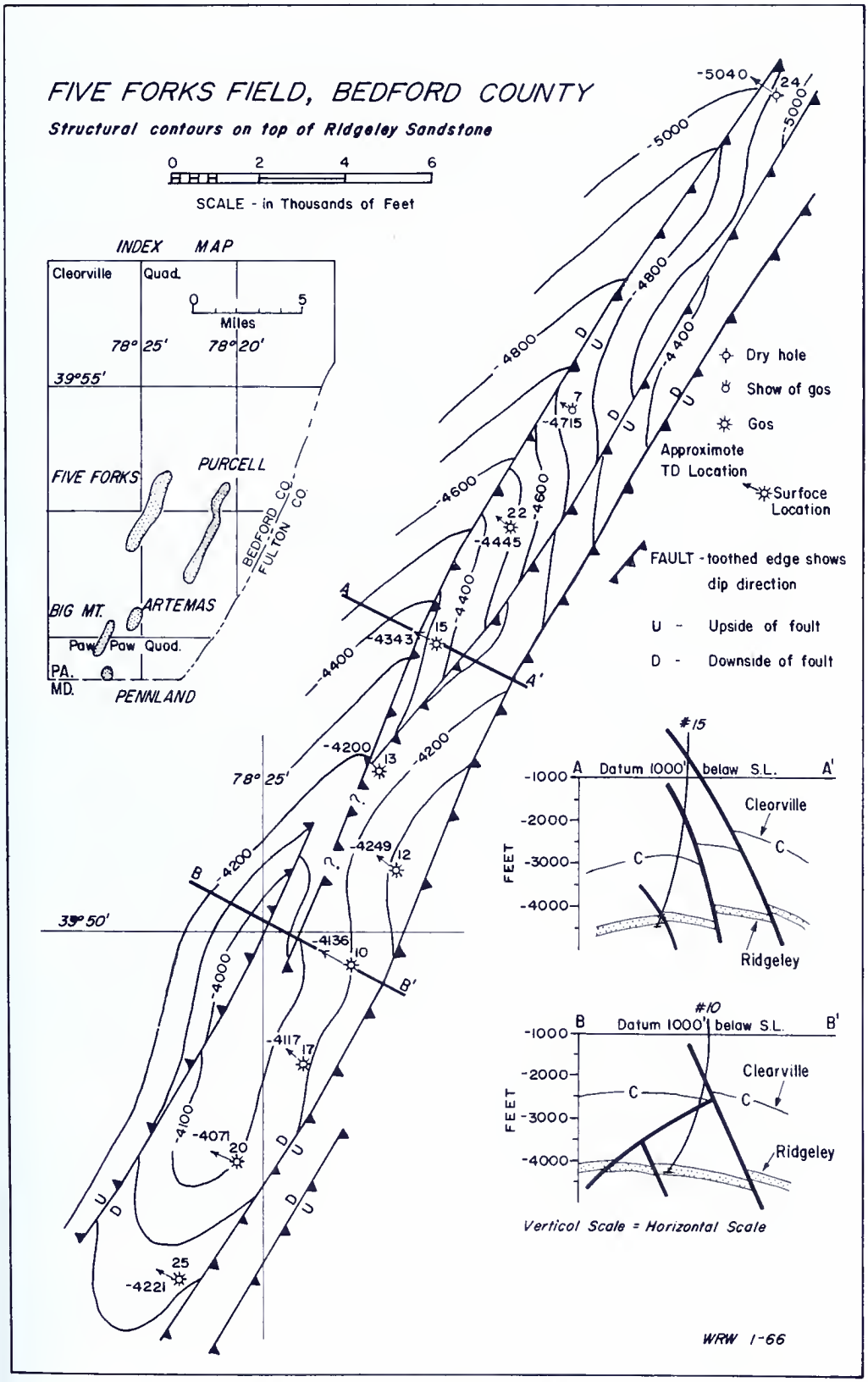


Figure 18. Five Forks Field structure map.

encountered in controlling the updip drift of the hole. In water wells surface locations were purposely moved an average of 500 to 700 feet down dip of the anticipated location at total depth. Thus most of the wells in the area plan to drift updip to the northwest. The subsurface location of the bottom of the hole as shown by the arrowhead tips in Figures 18 and 19 are only approximate because most of the directional logs have not been released to the Survey nor is the angle of deviation ever filled in on the well location plats submitted to the Department of Mines and Mineral Industries.

Determination of normal thickness of stratigraphic intervals in Bedford County is complicated by dipping strata, faulting, and structural flowage of shales from the flanks into the crests and troughs of folds. Consequently, the figures quoted in the table below as representing "normal" thicknesses may be of limited value.

APPROXIMATE NORMAL THICKNESS INTERVALS IN SOUTHERN BEDFORD COUNTY

Clearville to oolitic limestone	700 feet
Oolitic limestone to Purcell Limestone	1025 feet
Base of Purcell to top of Onondaga Limestone	160 feet
Onondaga to Oriskany (Ridgeley) Sandstone	100 feet
Ridgeley thickness	150-175 feet

The Five Forks Field (Figure 18) contains eight producers and two dry holes. The discovery well (Well #10) initially gauged 10,504 Mcf natural with a rock pressure of 2078 psi/106 hours. Each succeeding well yielded lower rock pressures than the preceding well indicating possible communication among wells. Production was 7,700,000 Mcf in 1963, 4,000,000 Mcf in 1964, and 1,400,000 Mcf in 1965. At present only a few wells are producing, the other wells having water incursion.

In 1963 the Artemas Field was found by well #18 (Figure 19) which measured 10,165 Mcf natural with a rock pressure of 1815 psi/92 hours. Two producing wells and one dry hole make up the field. Turned into line in 1964, the field produced 473,000 Mcf in 1964 and 42,000 Mcf in 1965. Only one well is still producing.

The one well Pennland Pool, discovered in 1964 (Well #1, Figure 19) gauged a low initial rock pressure of 1400 psi which seemed to indicate communication with the Artemas Field lying in the same fault block. The Pennland Pool yielded 600,000 Mcf during 1965.

Big Mountain, the most recently discovered field, has three producers and one dry hole. It was turned into line at the end of 1964 and in 1965 produced 700,000 Mcf. At the present time only the most northern well (#30) is still producing gas.

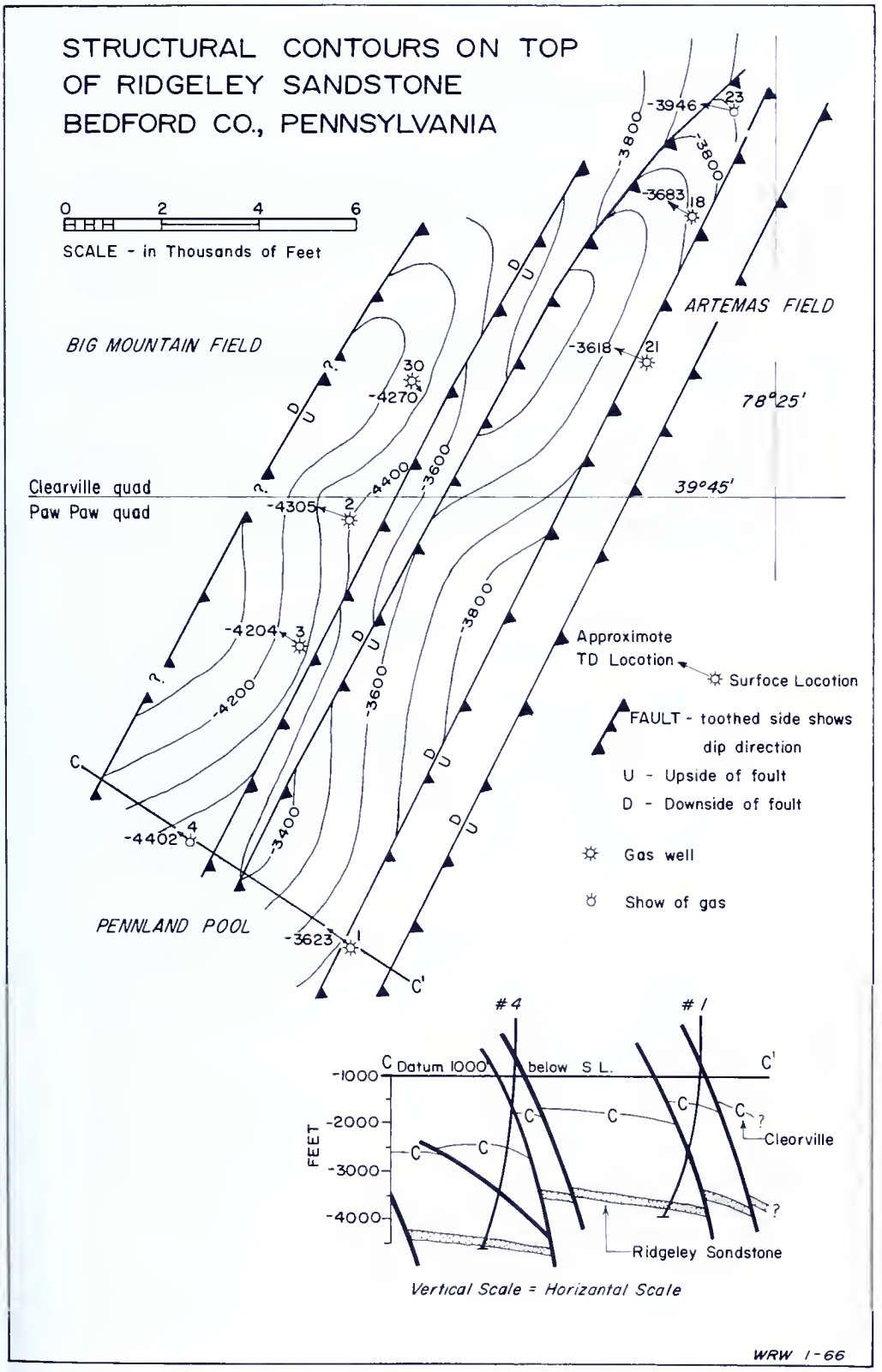


Figure 19. Structure map of the Artemas and Big Mountain Fields and the Pennland Pool. (See index map on Fig. 18 for locations of fields & pools.)

The Purcell Field, containing eight producers and nine dry holes, although discovered in 1957, was not connected into line until 1962. During 1963 and part of 1962 the field yielded 2,200,000 Mcf. However, in 1965 this volume was drastically reduced to 200,000 Mcf. The Purcell Field, like the other Bedford County fields, is almost depleted.

The writer gratefully acknowledges the assistance of Felmont Oil Corporation and New York State Natural Gas Corporation without whose aid the structure maps could not have been prepared.

References

Cate, A. S. (1963a), *Purcell Field,* in Lytle, W. S. and others (1963), *Oil and gas developments in Pennsylvania in 1962,* Pa. Geol. Survey, 4th ser., Prog. Rept. 165, p. 22-26.

———— (1963b), *Lithostratigraphy of some Middle and Upper Devonian rocks in the subsurface of southwestern Pennsylvania,* in Shepps, V. C., ed. (1963), *Symposium on Middle and Upper Devonian stratigraphy of Pennsylvania and adjacent states,* Pa. Geol. Survey, 4th ser., Bull. G39, p. 229-240.

OUTLOOK FOR 1966

One deep wildcat is of particular interest to the oil and gas operators. The well is being drilled in Potter County by Consolidated Gas Service Corporation. The well is scheduled to go to a total depth of 18,000 feet. At present it is drilling below 15,700 feet which makes it the deepest well in the Commonwealth. All other information is being held tight on this well.

Development will continue in the Medina play in Erie and Crawford Counties during 1966. As more of the Pierce Pool wells are connected to a gas transmission line, operators will drill additional development wells in this pool. The Bushnell-Lexington Pool will continue to have development through the year.

In the shallow oil and gas fields, exploratory and development drilling should increase during the year due to the continued healthy crude oil market and the success of hydraulic fracturing. The Pleasantville-Oil City-Tionesta area and the Big Run area should both see considerable activity.

If a pilot water flood in the Middle District is successful, an increase in water flooding in this district should take place. Two large fields in southwestern Pennsylvania are to be water flooded. This will be new for the area.

Several steam floods are in operation and others are planned. The steam flood in the Franklin-Oak Forest Field has been operating for over a year and has recently been increased in size. Although all information is tight, this area looks promising. Another promising steam flood, from all indications, is in the Bradford Field in New York State.

ARTICLES ON PENNSYLVANIA GEOLOGY, 1965

Cate, A. S. (1965), *Stratigraphic studies of the Silurian rocks of Pennsylvania*, Part 2, *Subsurface maps of the Silurian rocks of western Pennsylvania and adjacent areas*, Pa. Geol. Survey, 4th ser., Spec. Bull. 11, 8 p., 3 figs., 9 maps.

Colton, George W. and S. J. Luft (1965), *Bedrock geology of the Slate Run quadrangle, Clinton, Lycoming, and Potter Counties, Pennsylvania*, Pa. Geol. Survey, 4th ser., Prog. Rept. 167, 1 map (1:24,000) with stratigraphic column, short text, and 2 figs. on same sheet.

Cramer, Howard R. (1965), *Annotated bibliography of Pennsylvania geology—Supplement to 1959*, Pa. Geol. Survey, 4th ser., Bull. G-42, 237 p.

Cunningham, W. Roy (1965), *A summarization of the problems brought before the Pennsylvania Conservation Commission*, Interstate Oil Compact Comm. Bull., v. 7, no. 1, p. 12-16.

Dickey, Parke A. (1965), *Oil and gas field property line maps of the Titusville quadrangle*, Pa. Geol. Survey, 4th ser., Spec. Bull. 4 (2nd printing—original edition, 1946), 9 maps.

Drake, Avery A., Jr. (1965), *Carbonate rocks of Cambrian and Ordovician age, Northampton and Bucks Counties, eastern Pennsylvania, and Warren and Hunterdon Counties, New Jersey*, U. S. Geol. Survey Bull. 1197-L.

Duda, John R., Schrider, Leo A., and H. R. Johnson (1965), *Field performance of a pilot waterflood, Kane Oil Field, Elk County, Pa.—a progress report*, Producers Monthly, v. 29, no. 12, p. 8, 10.

Ellison, Robert L. (1965), *Stratigraphy and paleontology of the Mahantango Formation*, Pa. Geol. Survey, 4th ser., Bull. G-48, 299 p., 8 figs., 12 pls., 6 tables.

Flint, Norman K. (1965), *Geology and mineral resources of southern Somerset County, Pennsylvania*, Pa. Geol. Survey, 4th ser., Bull. C-56a, 267 p., 55 figs., 13 pls. including 1:62,500 geologic map.

Hull, J. P. D., Jr. (1965), *Appalachian anticlines need more testing*, Oil and Gas Jour., v. 63., no. 31 (August 2), p. 178-180.

Kerr, James F. (1965), *The mineral industry of Pennsylvania in 1963*, Pa. Geol. Survey, 4th ser., Inf. Circ. 53, 42 p.

Komar, C. A. and Pierce, C. E. (1965), *Acoustic velocities in oil reservoir formations from laboratory and field measurements*, Producers Monthly, v. 29, no. 2, p. 8, 10-12.

Lapham, Davis M. (1965), *A new nickeliferous magnesium hydroxide from Lancaster County, Pennsylvania*, Am. Mineralogist, v. 50, no. 10, p. 1708-16.

———— and Geyer, A. R. (1965), *Mineral collecting in Pennsylvania*, Pa. Geol. Survey, 4th ser., Bull. G-33 (2nd edition), 148 p., 75 figs.

Linn, Earl H. (1965), *Fracturing the Glade sand pay boosts Pennsylvania Grade output,* Oil and Gas Jour., v. 63, no. 50 (Dec. 13), p. 144-8.

Longwill, Stanley M. and Charles Wood (1965), *Ground-water resources of the Brunswick Formation in Montgomery and Berks Counties, Pennsylvania,* Pa. Geol. Survey, 4th ser., Bull. W-22, 59 p., 13 figs., 1 pl. (1:62,500 geologic map), 7 tables.

Lytle, William S. (1965), *Oil and gas geology of the Warren quadrangle,* Pa. Geol. Survey, 4th ser., Bull. M-52, 95 p., 6 figs., 8 pls.

———— (1965), *Pennsylvania's 1965 hydraulic fracture boom,* Pa. Internal Affairs Monthly Bull., v. 33, no. 6, p. 1-5.

———— (1965), *Developments in Pennsylvania,* 1964, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 6, p. 666-672.

———— (1965), *Results of stimulating the oil and gas sands by hydraulic fracturing in Pennsylvania,* Interstate Oil Compact Comm. Bull., v. 7, no. 1, p. 17-28.

———— (1965), *Pennsylvania—oil and gas development 1964,* Internatl. Oil Scouts Assoc. Yearbook 1965 (Review of 1964), v. 35, pt. 1, p. 279-283.

———— and others (1965), *Oil and gas developments in Pennsylvania in 1964,* Pa. Geol. Survey, 4th ser., Prog. Rept. 168, 55 p., 10 figs., 13 tables.

McGlade, William G. (1965), *Current activities in the Pennsylvania oil and gas fields,* Interstate Oil Compact Comm. Bull., v. 7, no. 1, p. 37-44.

O'Neill, Bernard J. (1965), *Directory of the mineral industry in Pennsylvania,* Pa. Geol. Survey, 4th ser., Inf. Circ. 54, 85 p.

———— and others (1965), *Properties and uses of Pennsylvania shales and clays,* Pa. Geol. Survey, 4th ser., Bull. M-51.

Overbey, William K., Jr. and Evans, Donald M. (1965), *Appalachian Region oil field reservoir investigations, Glade sand, Youngsville Pool, Youngsville-Sugar Grove oil field, Brokenstraw Township, Warren County, Pa.,* Producers Monthly, v. 29, no. 8, p. 14-16.

Price, Paul H. and Haught, Oscar L. (1965), *West Virginia drillers urged to go deeper,* Oil and Gas Jour., v. 63, no. 38 (Sept. 20), p. 252-253.

Shearrow, George G. and Preston, Arthur F. (1965), *Ohio drillers looking for better trap,* Oil and Gas Jour., v. 63, no. 28 (July 12), p. 142-149.

Shepps, Vincent C., compiler (1965), *Physiographic provinces map of Pennsylvania,* Pa. Geol. Survey, 4th ser., Map 13 (8½ x 11-inch colored map).

Sherrill, Richard E. (1965), *Oil and gas field property line maps of the Hilliards quadrangle,* Pa. Geol. Survey, 4th ser., Spec. Bull. 3 (2nd printing—original edition, 1946), 9 maps.

Swartz, Frank M. (1965), *Guide to the Horse Shoe Curve section between Altoona and Gallitzin, central Pennsylvania,* Pa. Geol. Survey, 4th ser., Bull. G-50, 56 p., 6 figs.

Weaver, O. D. (1965), *North flank of Appalachian set for testing,* Oil and Gas Jour., v. 63, no. 36 (Sept. 6), p. 216-219.

———— (1965), *New York offers multiple strat-trap potential in Cambro-Ordovician sediments,* Oil and Gas Jour., v. 63, no. 37 (Sept. 13), p. 166-170.

Table 9. *Deep gas production in Pennsylvania, 1965*

* "Shallow" Gas Production of Field Not Shown.
** Corrected Figures.

County	*Field*	*Pool*	*Discovery Date*	*Production in Mcf* *Cumulative Production at End of 1964*	*Production 1965*	*Cumulative Production at End of 1965*	*Status of Field or Pool at End of 1965*
Armstrong	Shellhammer*	Rupert	11/14/58	330,996	10,384	341,380	Producing
Bedford	Artemus	TOTAL:	7/30/63	1,473,000**	42,000	2,115,000	Producing
		Pennland	8/28/64		600,000	600,000	Producing
	Big Mt.		10/6/64		700,000	700,000	Producing
	Five Forks		6/21/62	11,700,000	1,400,000	13,100,000	Producing
	Purcell		12/14/57	2,600,000	200,000	2,800,000	Producing
Bedford & Blair	Pavia		11/20/61				Shut In
Cambria	Rager Mt.		10/16/65		1965 Discovery		Shut In
Cameron & Elk	Whippoorwill		7/10/61	10,300,000	1,300,000	11,600,000	Producing
Cameron, Elk, Jefferson, Clearfield & Indiana	Punxsutawney-Driftwood	TOTAL:	9/15/51	441,250,000	7,390,000	448,640,000	Producing
							Producing
		Benezette	1/5/53				
		Driftwood	9/15/51	233,500,000	1,800,000	235,300,000	Producing
		Boone Mt.	9/18/58				
		DuBois	1/6/60	91,100,000	3,000,000	94,100,000	Producing
		Sabula	8/26/63	350,000	190,000	540,000	Producing
		Helvetia	5/11/60				Producing
		Reed-	5/9/55				Producing
		Deemer	12/1/53	112,900,000	2,300,000	115,200,000	Producing
		Rockton	2/25/55				Producing
		Sykesville	11/10/60				Producing
		Hicks Run	6/7/56	3,400,000	100,000	3,500,000	Producing
Clarion	Clarion*	Mays	10/30/63	6,218		6,218	Shut In
Clinton & Potter	Leidy	TOTAL:	1/9/50	159,141,121	242,486	159,383,607	Gas Storage & Producing
		Ole Bull	1/9/59	4,341,089	242,486	4,583,575	Producing

Crawford & Erie	Conneaut	TOTAL:	2/11/57	5,658,719	4,364,079	10,022,798	Producing
		Beaver Creek	6/10/64		70,000	70,000	Producing
		Bushnell-Lexington	12/31/58	2,181,922	2,213,678	4,395,600	Producing
		Indian Spring	9/11/57	3,147,858	788,000	3,935,858	Producing
		Kastle	7/14/62		1,050,000	1,050,000	Producing
		Lundys Lane	11/9/61	328,939	122,401	451,340	Producing
		Scull	2/13/64		120,000	120,000	Producing
Erie	Burgess		10/17/60	91,488	12,0004	103,492	Producing
	Corry	TOTAL:	4/29/47	989,386	7,643	997,029	Gas Storage & Producing
		Beaver Dam	5/20/53	135,686	7,643	143,329	Producing
	Meade		8/23/46	4,895,222	2,797	4,898,019	Oriskany Gas Storage (One Producing Medina Well)
	Phillipsville		7/17/56	5,000		5,000	Shut In
		Dennee	10/8/65		1965 Discovery		
Fayette	Fike		8/8/63	87,044	44,616	131,660	Producing
	Ohiopyle		12/28/59	2,568,263	280,237	2,848,500	Producing
	Spruell		10/13/61				Shut In
	Summit	TOTAL:	3/24/38	40,430,496	361.520	40,792,016	Producing & Abandoned
		East Summit	12/31/60	27,150		27,150	Shut In
		Heyn	2/4/64	40,659		40,659	Abandoned
		North Summit	3/24/38	20,361,473	106,574	20,468,047	Producing
		South Summit	5/9/42	20,001,214	254,946	20,256,160	Producing
Indiana	Cherry Hill*	Crichton	1/9/63	1,507,383	225,199	1,732,582	Producing
		Hadden	7/11/63				
	Jacksonville		9/21/56	22,140,000**	1,860,000	24,000,000	Producing
	Nolo		9/30/56	6,200,000	200,000	6,400,000	Producing
Jefferson	Big Run	Elk Run	6/20/65		1965 Discovery		
Potter	Ellisburg	TOTAL:	9/1/33	79,600,000			Storage
		Bingham Center	1/2/39				Storage
		Ellisburg	9/1/33	79,600,000			Storage
		West Bingham	7/16/36				Storage
	Ulysses		10/2/39	2,336,709	262,650	2,599,359	Producing
		New Field	4/2/62				
Somerset	Boswell	TOTAL:	11/11/58	7,263,308	709,108	7,972,416	Producing
		Boswell	11/11/58	6,687,570	640,476	7,328,046	Producing
		Snyder	6/16/60	575,738	68,632	644,370	Producing
[illegible]		[illegible]	8/9/64		70,000	70,000	Shut In

Table 9. *Deep gas production in Pennsylvania, 1965, Continued*

County	*Field*	*Pool*	*Discovery Date*	*Production in Mcf* *Cumulative Production at End of 1965*	*Production 1965*	*Cumulative Production at End of 1964*	*Status of Field or Pool at End of 1965*
Warren	Camp Run		5/12/61	15,990	To be P & A	15,990	Shut In
Washington	Daniels Run*	Gylde	9/6/61	35,348	8,600	43,948	Producing
Westmoreland	Blairsville*	Kahl	10/23/62	7,203,105	1,479,817	8,682,922	Producing
		Tunnel	3/10/65		1965 Discovery		
	Latrobe*	Dry Ridge	8/25/46	1,926,011	1,092,005	3,018,016	Producing
	Jacobs Creek*	Bailey	12/26/61	296,974	102,292	399,266	Producing
	Lycippus	TOTAL:	8/17/49	5,120,083**	167,619	5,287,702	Producing & Abandoned
		Derry	12/5/58	85,835			Abandoned
		Piper	8/17/49	653,593			Abandoned
		St. Boniface Chapel	9/13/56	4,380,655	167,619	4,548,274	Producing
		Hribal	8/17/62				Abandoned
	Murrysville*	Sloan	10/22/63	37,061	27,713	64,774	Producing
		Duquesne	8/8/65		31,456	31,456	Producing
Westmoreland & Somerset	Johnstown	TOTAL:	5/16/57	14,882,441	1,553,943	16,436,384	Producing
		Baldwin	5/22/60	5,117,055	541,107	5,658,162	Producing
		Beck	5/16/57				
		Williams	2/14/58	9,765,386	1,012,836	10,778,222	Producing
	Seven Springs	TOTAL:	12/15/58	4,556,358	432,092	5,088,450	Producing & Abandoned
		Blair	12/5/58	3,872,589	507,590	4,380,179	Producing
		Clarke	3/15/61	357,563	24,502	382,065	Producing
		Kooser	5/19/59	326,206		326,206	Abandoned

Table 10. *Summarized records of deep wells drilled in Pa. in 1965*

MAP NUMBER	1	2	3	4	5	6	7	8	9	10
COUNTY / Permit Number	BEAVER 12	BEDFORD 34P	BEDFORD 38	BEDFORD 36	BEDFORD 37P	CAMBRIA 6	CAMBRIA 5	CAMERON 31	CLARION 247	CLEARFIELD 387P
NAME OF WELL	Frank Cole 1	Shellsburg Unit 1	S. C. Boor 1	R. H. Jay 1	Leroy LaMaster 2	M. E. Bole 1	Geo. L. Reade 1	Emporium Water Co., 1	H. Amsler 1	Lilly Leamer 1
OPERATOR	Peoples Natural Gas Co. #4474	Kerr-McGee Oil Industries	M. L. & H. Co. #4831	Consolidated Gas Supply Corp. N-971	Consolidated Gas Supply Corp. N-962	T.W. Phillips Gas and Oil Co.	PNG Bethlehem Steel Co. Snee & Eberly	Belmont Oil Corp.	Fairman Drilling Co.	NYSNG Corp. N-963
TOWNSHIP	South Beaver	Napier	Monroe	Mann	Mann	Jackson	Jackson	Lumber	Piney	Burnside
QUADRANGLE	New Castle 10	Bedford 3	Clearville 32	Clearville 31	Paw Paw 4	Johnstown 4	Johnstown 3	Emporium 13	Clarion 6	Barnesboro 16
LATITUDE	8500 ft. N 40° 45'	7300 ft. N 40° 05'	7700 ft. S 39° 55'	2700 ft. N 39° 45'	7150 ft. S 39° 45'	5100 ft. S 40° 25'	1850 ft. S 40° 25'	12,700 ft. N 41° 30'	3000 ft. S 41°00'10'	3700 ft. S 40° 45'
LONGITUDE	9300 ft. E 80° 30'	9300 ft. W 78° 35'	100 ft. W 78° 20'	5500 ft. E 78° 25'	12,100 ft. W 78° 25'	9400 ft. W 78° 55'	7900 ft. W 78° 55'	2900 ft. E 78° 10'	1500 ft. E 79° 30'	4100 ft. W 78° 45'
DATE COMPLETED	11-30-65	3-24-65	12-10-65	3-20-65	5-5-65	12-27-65	10-16-65	5-18-65	9-17-65	1-20-65
ELEVATION	1120 DF	1663 KB	1386	1000	1056	2551 DF	2528	1978 RT	1280 DF	1587 DF
TULLY	4383-	Helderberg 29- Keyser 85-	Clearville 3825-	Clearville 3860- Purcell 5230-	Clearville 3551- 3582 Oolitic 3883-90	6907-	6940-	6078-6138	5123-	7353-7397
ONONDAGA LIMESTONE / CHERT	4533-	Tonolaway 215- Wills Creek 1055- Bloomsburg 1435-		5475-	5345-	7675- 7688-	7685- 7699-	6701-	5431-	8144- 8153-
ORISKANY	4730- Shriver 4775?-	McKenzie 1470- Rochester 1820- Keefer 1880-		5620-	5458-	7790-	7796-	6716-	5488- Shriver 5491-	8242-
HELDERBERG		Rose Hill 1930- Thorold"2630-						6767?-		
SALINA		Castanea 2660- Tuscarora 2735-2810								
GUELPH-LOCKPORT		Fault 2810 Rose Hill 2810- Thorold 3085- Castanea 3115-								
CLINTON		Tuscarora 3202- Juniata 3618- Reedsville 5442-								
MEDINA		Coburn 7628- Bellefonte (Upper Member) 8680?-								
QUEENSTON		Mines 11,530?-								
TOTAL DEPTH	4806	11,850	6121	5795	5717	7821	7810	6770	5828	8353
DEEPEST FORMATION REACHE	Shriver	Mines?	Clearville	Shriver?	Shriver?	Oriskany	Oriskany	Helderberg	Salina	Helderberg
RESULT	Dry HF SW AF Abandoned	SW at 3327 Abandoned	Did not reach Onondaga Faulted below Clearville Abandoned	67 Mcf gas and 250 gal. SW per hr. Abandoned	Purcell 5113-5247 94 Mcf gas AF Abandoned	15,300 Mcf gas natural RP 3235 psi. 17 hrs.	8245 Mcf gas natural, RP 3193 psi. 168 hrs. Discovery Well Rager Mt. Pool	670 ft. SW in 5 hrs. Show gas 3000- Abandoned	Show of gas in Helderberg Abandoned	321 Mcf gas 12 gals. SW AF Abandoned

DF, Derrick floor

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	11	12	13	14	15	16	17	18	19	20
COUNTY / Permit Number	CLEARFIELD 398	CRAWFORD 179	CRAWFORD	CRAWFORD 410	CRAWFORD 171	CRAWFORD 170	CRAWFORD 185	CRAWFORD	CRAWFORD 168	CRAWFORD 180
NAME OF WELL	John M. Chase 1	L. & M. Lipscey 1	Birtikidis 1	Burnham 1	Wm. Eells 1	Howard Green 4	G. Mackey	Jos. Nagee 1	Pa. Game Lands Tr 101#1 (Fuller)	Pa. Game Lands Tr 101#2 (Fuller)
OPERATOR	Consolidated Gas Supply Corp.	Ventura Oil Co.	The Sylvania Corp.	James Drilling Co.	Ventura Oil Co.	James Drilling Co.	The Sylvania Corp. #432	The Sylvania Corp.	Hanley & Bird Sold to Transam.	Transamerican Petroleum Corp.
TOWNSHIP	Knox	Cussewago	Spring	Spring	Cussewago	Spring	Spring	Spring	Beaver	Beaver
QUADRANGLE	Houtzdale 6	Cambridge Springs 21	Girard 237	Girard 195	Girard 169	Girard 180	Girard 238	Girard 240	Girard 196	Girard 190
LATITUDE	4000 ft. S 40° 55'	1900 ft. N 41° 45'	13,800 ft. S 41° 50'	8700 ft. N 41° 45'	9300 ft. N 41° 45'	6600 ft. N 41° 45'	15,200 ft. S 41° 50'	13,600 ft. S 41° 50'	2100 ft. N 41° 50'	950 ft. N 41° 50'
LONGITUDE	10,700 ft. W 78° 25'	5800 ft. E 80° 15'	7200 ft. W 80° 20'	4950 ft. W 80° 20'	650 ft. W 80° 15'	3600 ft. E 80° 25'	4800 ft. W 80° 20'	2450 ft. W 80° 20'	10,450 ft. W 80° 25'	10,400 ft. W 80° 25'
DATE COMPLETED	12-16-65	11-19-65	12-23-65	5-14-65	1-12-65	1-4-65	12-31-65	12-15-65	6-11-65	5-11-65
ELEVATION	1648 DF	1122 KB	1100 DF	1180	1126 RT	1072 G	1175 G	1218 DF	1007 KB	1009 KB
TULLY	7125-7198	2370-			2315-	2188-2213				1995-
ONONDAGA	8020- chert 8038	2556-	2356-		2496-	2352-	2445-	2495-	2156-	2158-
ORISKANY	8088-				2692- Bass Is. 2697-	2557?-Horizon Bass Is. 2557-				2426?-Horizon
SALINA					2763-	2634-				2498-
GUELPH-LOCKPORT Black Water					3410-	3278- BW at 3420				3024-
CLINTON IRONDEQUOIT		3810-	3584-	3696-	3654- 3727-3732	3513- 3584-3594	3667-	3700-	3328-	3284- 3337-3348
MEDINA			gas		3766-	3611- Cabot Head 3708-	Cabot Head 3781-	gas		3368- Cabot Head 3460-
QUEENSTON				3922-	3944-	3800-			3540?-	3548-
MIDDLE ORDOVICIAN LIMESTONES						5612-				5345-6002
GATESBURG						SW at 6230			6028?-	6002-
TOTAL DEPTH	8131	4098	3800	3965	4012	6314	3842	3907	6050	6074
DEEPEST FORMATION REACHED	Helderberg	Queenston	Queenston	Queenston	Queenston	Gatesburg	Cabot Head	Medina	Gatesburg	Gatesburg
RESULT	Abandoned	?	564 Mcf gas AF RP 850 psi. 14 hrs.	5000 Mcf gas AF RP 1120 psi. 7 days	1120 Mcf gas AF RP 1125 psi. 12 hrs.	1000 Mcf gas AF RP 820 psi. 24 hrs.	669 Mcf gas AF RP 890 psi. 40 hrs.	309 Mcf gas AF RP 850 psi. 14 hrs.	150 Mcf after acidizing Abandoned	SW at 6022 Abandoned

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	21	22	23	24	25	26	27	28	29	30
COUNTY Permit Number	CRAWFORD 176P	CRAWFORD 175	CRAWFORD 177	ERIE	ERIE	ERIE 154	ERIE 163	ERIE 178	ERIE 188	ERIE 189
NAME OF WELL	L. K. Sensebeugh 1	G. S. Sprouse 2	R. Reinhart 1	N. Mathewson 1	Weaver 1	Maud Follette 4	Maud Follette 5	A. Miller 2	V. Anderson 2	Avey (M. White) 1
OPERATOR	Transamerican Petroleum Corp.	Transamericen Petroleum Corp.	The Sylvanie Corp. #404	Sunset Internat. Petroleum Corp.	Sunset Internat. Petroleum Corp.	Pa. Gas Co. #1609	Pa. Gas Co.	Ceyman Corp.	James Drilling Co.	James Drilling Co.
TOWNSHIP	Beaver	Beaver	Conneaut	Franklin	McKean	Wayne	Wayne	Springfield	Conneaut	Conneaut
QUADRANGLE	Girard 178	Girard 179	Linesville 32	Cambridge Springs 19	Cambridge Springs 20	Corry 27	Corry 28	Fairview 4	Girard 206	Girard 205
LATITUDE	3500 ft. S 41° 50'	8200 ft. S 41° 50'	2000 ft. S 41° 45'	6200 ft. N 41° 55'	7000 ft. S 42° 00'	12,600 ft. S 42° 00'	12,300 ft. S 42° 00'	450 ft. N 42° 00'	8700 ft. N 41° 50'	10,600 ft. S 41° 55'
LONGITUDE	8500 ft. E 80° 30'	8300 ft. W 80° 25'	4500 ft. E 80° 25'	8500 ft. W 80° 10'	7400 ft. W 80° 05'	6700 ft. E 79° 45'	6100 ft. E 79° 45'	8200 ft. W 80° 25'	7200 ft. W 80° 25'	9500 ft. W 80° 25'
DATE COMPLETED	2-19-65	1-30-65	1-8-65	6-11-65	8-18-65	5-12-65	7-23-65	9-28-65	7-16-65	7-3-65
ELEVATION	999 KB	1020 KB	1088 DF	1290 DF	1366 DF	1758	1773 G	609 DF	965	930 D
TULLY		1983-		2167-	2184-	2879-	2886-		1867-	
ONONDAGA	2128-	2144-	2400-		2425-	3125-	3131-	1312-	2031-	1930-
ORISKANY		2395-						1600?-	SW 2321	
SALINA		2480-				3400-		1719-		
GUELPH - LOCKPORT Block Water		3106-		SD at 3360 BW at 3400		3968-	3966-	2210-		BW at 2900
CLINTON IRONDEQUOIT	3345?-	3340- 3410-3420	3658-		3545?-	4218- 4286-4296	4224-	2460- 2512-2523		3117-3127
MEDINA		3441- gas	Grimsby 3715-	3573- 43 Mcf gas & SW		4324-	4330-	2540-	3288-	
QUEENSTON	3566-	3626-	3889-	3737-	3740-			2707-	3420?-	3319-
MIDDLE ORDOVICIAN LIMESTONES	5373-									
GATESBURG	SW at 6050	6076- SW 6135								
TOTAL DEPTH	6099	6189	3896	3783	3768	4491	4496	2760	3460	3350
DEEPEST FORMATION REACHED	Getesburg	Getesburg	Medina	Queenston	Queenston	Whirlpool	Whirlpool	Queenston	Queenston	Queenston
RESULT	SW 2385 Abandoned	PB to 3580 974 Mcf gas AF RP 1050 psi 48 hrs.	Abandoned	100 Mcf gas and SW AF RP 575 psi.	SO, SG, SW at 2698 Not fractured Abendoned	Show gas 1180 Drilled for Gas Storage	Drilled for Gas Storage	950 Mcf gas AF RP 915 psi 48 hrs.	560 Mcf gas AF RP 875 psi. 24 hrs.	1600 Mcf gas some SW AF RP 825 psi. 12 hrs.

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	31	32	33	34	35	36	37	38	39	40
COUNTY Permit Number	ERIE 136	ERIE 141	ERIE 167	ERIE 133	ERIE 186	ERIE 168	ERIE	ERIE 166	ERIE	ERIE 183
NAME OF WELL	W. R. Babb, Jr. 1	Rena Barkar 2	R. D. Beckman 1	R. L. Blood 2	Caska 1	O. & R. Chapman 1	J. G. Chase 1	R. A. Davidson 1	P. Dominick 1	F. Erickson 1
OPERATOR	Jamas Drilling Co.	Paul Britton et al	Betz Oil Co. Inc.	Paul Britton et al	Cayman Corp.	Betz Oil Co. Inc.	Pa. Gas Co. #1613	Cayman Corp.	Cayman Corp.	Cayman Corp.
TOWNSHIP	Conneaut	Conneaut	Conneaut	Conneaut	Springfield	Conneaut	Connaaut	Springfield	Springfiald	Springfiald
QUADRANGLE	Girard 173	Girard 181	Girard 185	Girard 177	Girard 231	Girard 192	Girard 229	Girard 218	Girard 243	Girard 239
LATITUDE	16,050 ft. S 41° 55'	9550 ft. S 41° 55'	2450 ft. S 41° 55'	3500 ft. S 41° 55'	17,000 ft. S 42° 00'	200 ft. S 41° 55'	2900 ft. S 41° 55'	8650 ft. S 42° 00'	6500 ft. S 42° 00'	10,500 ft. S 42° 00'
LONGITUDE	4200 ft. W 80° 25'	2600 ft. W 80° 30'	5700 ft. W 80° 25'	2800 ft. E 80° 30'	14,000 ft. W 80° 25'	5100 ft. W 80° 25'	1200 ft. E 80° 25'	4700 ft. W 80° 25'	17,500 ft. S 80° 20'	5200 ft. E 80° 25'
DATE COMPLETED	1-14-65	1-11-65	3-30-65	1-22-65	10-10-65	5-3-65	10-13-65	8-7-65	12-16-65	11-24-65
ELEVATION	914? 0	904 0	920 0	894? G	712 DF	882 DF	950 RT	705 DF	726 KB	728 KB
TULLY	1785-1832	1690-		1654-1685		1627-	1738-	1307-	1360-	1350-
ONONDAGA	1950-	1843-	1860-	1808-		1791-	1904-	1470-	1573-	1528-
ORISKANY	22209- horizon			2097-			2162-2170	17577-1789	1874-1894	18287-
SALINA	2295-			2193-			2271-	1866-	1971-	1915-
GUELPH - LOCKPORT Black Water	2860-			2724-			2806-	2368-	2395-	2346-
CLINTON IRONDEQUOIT	3103- 3170-3180	3056-	3070-	2954- 3021-3034	2686- 2750-2762	2994-	3053- 3116-3128	2624- 2674-2686	2659- 2711-2723	2662- 2712-2723
MEDINA	3203-			3053-	2781-		3141-	2705-	2742-	2742-
QUEENSTON	3375-			3230±		3194-	3315-		2908-	29107-
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	3398	3240	3240	3231	2917	3248	3363	2806	2923	2946
DEEPEST FORMATION REACHED	Queenston	Medina	Medina	Quaenston	Medina	Queenston	Queenston	Medina	Queenston	Quaenston
RESULT	1500 Mcf gas AF RP 1080 psi. 24 hrs.	1250 Mcf gas AF RP 1060 psi. 12 hrs.	3000 Mcf gas AF	1900 Mcf gas AF RP 1075 psi. Est. 10 BOPD	1200 Mcf gas AF RP 900 psi. 24 hrs.	5000 Mcf gas AF RP 1350 psi.	3200 Mcf gas AF RP 1050 psi. 12 hrs.	4400 Mcf gas AF RP 950 psi. 12 hrs.	1353 Mcf gas AF RP 961 psi. 96 hrs.	1370 Mcf gas AF RP 943 psi. 24 hrs.

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	41	42	43	44	45	46	47	48	49	50
COUNTY Permit Number	ERIE 144	ERIE 187	ERIE 146	ERIE 165	ERIE 182	ERIE	ERIE 152	ERIE	ERIE	ERIE 172
NAME OF WELL	Forinash 1	A. & M. Graves	B. Griffey 2	J. M. Hall 1	J. Hall 2	Hammond 1	Hartman-Crist 1	Heaton 1	Hill 1	P. Holdson 1
OPERATOR	James Drilling Corp.	Robert Thorson Co.	Ventura Oil Co.	Cayman Corp.	Cayman Corp.	James Drilling Corp.	Worldwide Pet. Corp.	Marsidell Inc.	James Drilling Corp.	Cayman Corp.
TOWNSHIP	Conneaut	Conneaut	Conneaut	Springfield	Springfield	Conneaut	Conneaut	Conneaut	Conneaut	Springfield
QUADRANGLE	Girard 174	Girard 242	Girard 187	Girard 217	Girard 235	Girard 121	Girard 186	Girard 225	Girard 214	Girard 226
LATITUDE	18,000 ft. S 41° 55'	15,400 ft. S 41° 55'	3600 ft. S 41° 55'	7200 ft. S 42° 00'	7200 ft. S 42° 00'	11,900 ft. S 41° 55'	10,550 ft. S 41° 55'	13,200 ft. S 41° 55'	8500 ft. S 41° 55'	13,100 ft. S 42° 00'
LONGITUDE	10,200 ft. W 80° 25'	2300 ft. W 80° 25'	7800 ft. E 80° 30'	1900 ft. W 80° 25'	600 ft. E 80° 25'	4200 ft. E 80° 30'	7200 ft. W 80° 25'	1350 ft. W 80° 25'	3200 ft. E 80° 30'	11,600 ft. W 80° 25'
DATE COMPLETED	1-21-65	10-1-65	3-17-65	8-7-65	11-1-65	9-4-65	3-24-65	10-26-65	8-25-65	9-29-65
ELEVATION	944 G	916 DF	935 DF	715 DF	712 G	935 DF	916 G	885 DF	909 DF	665 G
TULLY					1320-			1730-		
ONONDAGA	1990-	1952-	1849-	1485-	1500?-	1875?-		1904-	1880-	1480-
ORISKANY	SW 2265			1780?-	1793?-					1759?-1794
SALINA				1896-	1900-					1868-
GUELPH - LOCKPORT Black Water	Blk W at 3050			2386-	2385-					2375-
CLINTON IRONDEQUOIT	3221-3232	3170-	3070-	2640- 2690-2702	2653- 2706-2717	3116-	3120-	3132-	3070-	2626- 2679-2690
MEDINA	3263-			2720-	2736-					2708-
QUEENSTON	3430-		3265-		2901-	3316-			3278-	2875-
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	3438	3333	3271	2851	2925	3325	3320	3310	3296	2917
DEEPEST FORMATION REACHED	Queenston	Medina	Queenston	Medina	Queenston	Queenston	Queenston?	Medina	Queenston	Queenston
RESULT	3100 Mcf gas AF RP 860 psi. 24 hrs.	1123 Mcf gas AF RP 850 psi. 12 hrs.	5200 Mcf gas AF RP 1070 psi.	1125 Mcf gas AF RP 950 psi. 12 hrs.	1500 Mcf gas AF RP 967 psi. 48 hrs.	1600 Mcf gas AF RP 1035 psi. 4 days	8000 Mcf gas AF RP 1280 psi. 12 hrs.	250 Mcf gas AF RP 450 psi.	1600 Mcf gas AF RP 900 psi. 12 hrs.	750 Mcf gas AF RP 925 psi. 24 hrs.

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	51	52	53	54	55	56	57	58	59	60
COUNTY Permit Number	ERIE 190	ERIE	ERIE 140	ERIE 176	ERIE	ERIE 145	ERIE 175	ERIE	ERIE 151	ERIE 134
NAME OF WELL	M. Hope 2	Houston 1	D. Huston 3	Krans 1	Larson 1	R. Leonhart 1	R. Leonhart 2	A. Lippold 1	H. C. Marcy 2	R. A. McCrady 2
OPERATOR	James Drilling Corp.	James Drilling Corp.	Ventura Oil Co.	J. Sterling McCluskey	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	Paul Britton et al
TOWNSHIP	Conneaut	Conneaut	Conneaut	Conneaut	Conneaut	Conneaut	Conneaut	Conneaut	Conneaut	Conneaut
QUADRANGLE	Girard 216	Girard 223	Girard 182	Girard 230	Girard 209	Girard 183	Girard 197	Girard 211	Girard 184	Girard 175
LATITUDE	8700 ft. N 41° 50'	10,000 ft. S 41° 55'	9500 ft. N 41° 50'	600 ft. S 41° 55'	7200 ft. N 41° 50'	13,050 ft. S 41° 55'	12,700 ft. S 41° 55'	11,200 ft. S 41° 55'	4100 ft. S 41° 55'	8400 ft. S 41° 55'
LONGITUDE	5000 ft. W 80° 25'	4200 ft. E 80° 30'	5200 ft. W 80° 30'	1000 ft. W 80° 25'	5150 ft. W 80° 30'	8200 ft. E 80° 30'	12,200 ft. W 80° 25'	11,500 ft. W 80° 25'	8200 ft. W 80° 25'	4500 ft. W 80° 25'
DATE COMPLETED	7-30-65	9-17-65	2-4-65	10-12-65	7-26-65	3-7-65	5-22-65	7-28-65	3-18-65	1-3-65
ELEVATION	954 DF	930 DF	962 G	880? G	980 G	952? G	941? DF	939 RT	912 RT	910 RT
TULLY			1806-			1772-	1768-1803		1690-	1715-
ONONDAGA		1885-	1955-	1814-	2003-	1930-	1932-	1928-	1860-	1882-
ORISKANY			2230-2243			2228-2238?	2218-2223+		2150-2158	2157-2167
SALINA			2329-			2308-	2298-		2248-	2243-
GUELPH-LOCKPORT Block Water	-3143		2890-	SG		2852- -3070	2845-		2757- -2816	2798-
CLINTON IRONDEQUOIT	3260?-	3100-	3123- 3193-3204	3045?-		3090- 3156-3169	3084- 3150-3163	3135-	3010- 3075-3088	3030- 3100-3112
MEDINA			3220-		SO	3190-	3173-		3108-	3133-
QUEENSTON	3465-					3361-	3352-		3274-	
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	3490	3337	3319	3285	3424? 3460?	3408	3363	3380	3303	3258
DEEPEST FORMATION REACHED	Queenston	Medina	Medina	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Medina
RESULT	600 Mcf gas AF RP 720 psi. 12 hrs.	2000 Mcf gas AF RP 1020 psi. 12 hrs.	1078 Mcf gas AF RP 1075 psi. 12 hrs.	5443 Mcf gas AF RP 1090 psi.	3000 Mcf gas AF RP 890 psi. 12 hrs.	2200 Mcf gas AF RP 920 psi. 24 hrs.	2000 Mcf gas and SO AF RP 975 psi. 12 hrs.	2500 Mcf gas AF RP 925 psi. 12 hrs.	3000 Mcf gas AF RP 1050 psi. 24 hrs.	1000 Mcf gas AF RP 1065 psi.

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	61	62	63	64	65	66	67	68	69	70
COUNTY Permit Number	ERIE 156	ERIE 164	ERIE 174	ERIE 204	ERIE 180	ERIE 193	ERIE 170	ERIE 160	ERIE 167	ERIE 177
NAME OF WELL	R. A. McCrady 1	McCrady (Aljean) 2	H. Mershon 1	J. R. Miller A1	P. Mosinski 1	N. Nesbitt 1	J. Cravetz 1	M. & H. Panko	Pa. State Game Lands Tr 101,no.1	C. M. Randall 1
OPERATOR	J. Sterling McCluskey	J. Sterling McCluskey	Cayman Corp.	Cayman Corp.	Cayman Corp.	Cayman Corp.	Worldwide Pet. Corp.	Robert Thorsen	Lewis Operating Co.	Jamea Drilling Corp.
TOWNSHIP	Conneaut	Conneaut	Springfield	Springfield	Springfield	Springfield	Conneaut	Elk Creek	Conneaut	Conneaut
QUADRANGLE	Girard 202	Girard 219	Girard 224	Girard 222	Girard 233	Girard 220	Girard 198	Girard 207	Girard 208	Girard 199
LATITUDE	2150 ft. S 41° 55'	600 ft. S 41° 55'	5100 ft. S 42° 00'	2700 ft. S 42° 00'	10,900 ft. S 42° 00'	7000 ft. S 42° 00'	12,600 ft. S 41° 55'	15,500 ft. S 41° 55'	17,500 ft. S 41° 55'	12,000 ft. S 41° 55'
LONGITUDE	3600 ft. W 80° 25'	3500 ft. W 80° 25'	8000 ft. W 80° 25'	8300 ft. W 80° 25'	4500 ft. W 80° 25'	6400 ft. W 80° 25'	4050 ft. W 80° 25'	500 ft. E 80° 20'	7600 ft. E 80° 30'	6700 ft. W 80° 25'
DATE COMPLETED	6-9-65	8-5-65	9-20-65	8-31-65	11-6-65	8-24-65	5-27-65	7-8-65	8-2-65	6-4-65
ELEVATION	905 DF	879 DF	657 DF	656 DF	718 DF	674 DF	914 G	1048 G	944 KB	910 G
TULLY					1343-	1255-			1775-	1732-
ONONDAGA	1820-	1808-	1402-	1384-	1520-	1428-		2136-	1942-	1899-
ORISKANY	SW at 2118	SW at 2115	1699?-1728	1668-1698	1803?-1834	1704?-1741?	SW at 2185	SO, SW	2228-2240	SW
SALINA			1807-	1782-	1912-	1822-			2325-	
GUELPH - LOCKPORT Black Water			2300-	2286-	2416-	2326-	-3400		2865- SW	
CLINTON IRONDEQUOIT	3025-	3020-	2545- 2604-2615	2524- 2586-2598	2672- 2725-2736	2585- 2635-2646	3138-	3350-	3095- 3175-3185	3122-
MEDINA		3050-	2628-	2617-	2754-	2659-			3210-	
QUEENSTON		3245-	2801-	2784-	2929?-	2832-				3319?-
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	3262	3273	2834	2850	2931	2861	3329	3476	3331	3333
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Medina	Medina	Medina	Queenston
RESULT	8000 Mcf gas AF RP 1150 psi. 12 hrs.	5000 Mcf gas AF RP 1050 psi. 12 hrs.	900 Mcf gas AF RP 930 psi. 24 hrs.	3100 Mcf gas AF RP 900 psi. 24 hrs.	3290 Mcf gas AF RP 940 psi. 7 days	3800 Mcf gas AF RP 920 psi.	350 Mcf gas AF RP 1060 psi. 24 hrs.	5000 Mcf gas AF RP 1085 psi. 24 hrs.	500 Mcf gas AF RP 765 psi. 14 hrs.	2500 Mcf gas AF RP 1040 psi. 12 hrs.

Table 10. *Summarized records of deep wells, continued*

MAP NUMBER	71	72	73	74	75	76	77	78	79	80
COUNTY Permit Number	ERIE 185	ERIE	ERIE 161	ERIE 194	ERIE 138	ERIE 179	ERIE 162	ERIE 171	ERIE 169	ERIE 184
NAME OF WELL	Reinke 1	Revack 1	W. C. Roneker 1	K. Ruland 1	M. W. Ryan 1	M. Stoner 1	R. Taylor 1	J. G. Tercho 1	C. L. Thomas 1	H. Turner 1
OPERATOR	Cayman Corp.	James Drilling Corp.	Cayman Corp.	Cayman Corp.	Worldwide Pet. Corp.	Worldwide Pet. Corp.	Pa. Gas Co. #1611	Worldwide Pet. Corp.	Betz Oil, Inc.	Cayman Corp.
TOWNSHIP	Springfield	Conneaut	Springfield	Springfield	Conneaut	Conneaut	Conneaut	Conneaut	Springfield	Springfield
QUADRANGLE	Girard 232	Girard 215	Girard 210	Girard 241	Girard 176	Girard 228	Girard 204	Girard 213	Girard 212	Girard 234
LATITUDE	15,400 ft. S 42° 00'	13,000 ft. S 41° 55'	5100 ft. S 42° 00'	11,000 ft. S 42° 00'	8800 ft. S 41° 55'	12,300 ft. S 41° 55'	6500 ft. S 41° 55'	11,000 ft. S 41° 55'	2700 ft. N 41° 55'	2900 ft. S 42° 00'
LONGITUDE	5700 ft. W 80° 25'	3300 ft. E 80° 30'	4100 ft. W 80° 25'	7300 ft. W 80° 25'	8400 ft. W 80° 25'	6900 ft. W 80° 25'	16,150 ft. W 80° 25'	5900 ft. W 80° 25'	3600 ft. W 80° 25'	4200 ft. W 80° 25'
DATE COMPLETED	10-10-65	8-19-65	7-18-65	12-9-65	2-1-65	10-4-65	7-7-65	8-6-65	8-9-65	11-1-65
ELEVATION	722 DF	946 DF	674 DF	719 KB	915 G	922 DF	916 DF	912 DF	876 DF	668 KB
TULLY		1757-	1246-	1346-		1740-	1702-	1724-		1222-
ONONDAGA	1648-	1915-	1422-	1520-	1890-	1908-	1860-	1890-	1786-	1400-
ORISKANY	1943-1967		1707-1743	1806-1840	SW	SW at 2185	2156?-2165	SO at 2153 SW at 2156		1685-1713
SALINA	2046-		1826-	1879-			2240-			1792-
GUELPH-LOCKPORT Block Water	2465-		2324-	2418-			2754-	-2944		2283-
CLINTON IRONDEQUOIT	2716- 2770-2781	3133-	2578- 2628-2641	2676- 2729-2740	3104-	3135-	3000- 3066-3077	3117-	2983-	2552- 2602-2613
MEDINA	2804-	3160-	2656-	2757-			3099-			2632-
QUEENSTON	2962-	3334-		2924?-			3268-			2795-
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	2973	3381? 3355?	2801	2959	3289	3307	3284	3315	3260	2846
DEEPEST FORMATION REACHED	Queenston	Queenston	Medina	Queenston	Medina	Medina	Queenston	Queenston?	Queenston	Queenston
RESULT	800 Mcf gas AF RP 930 psi. 48 hrs.	1100 Mcf gas AF RP 975 psi. 36 hrs.	4000 Mcf gas AF RP 1020 psi. 12 hrs.	2500 Mcf gas AF RP 945 psi. 96 hrs.	1500 Mcf gas AF RP 1020 psi.	1036 Mcf gas AF RP 1050 psi. 24 hrs.	1478 Mcf gas AF RP 900 psi. 16 hrs.	2700 Mcf gas AF RP 925 psi. 12 hrs.	6000± Mcf gas AF RP 1500 psi?	891 Mcf gas AF RP 865 psi. 4 days

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	81	82	83	84	85	86	87	88	89	90
COUNTY Permit Number	ERIE 142	ERIE 201	ERIE 153	ERIE 149	ERIE 173	ERIE 157	ERIE 150	ERIE 146	ERIE 155	ERIE 158
NAME OF WELL	E.&M. Van Gorder 1	Harry Van Slyke 1	J. Viola 1	Weindorf 1	H. P. Weldon 1	N.J. & M. Weldon 1	J. L. White 1 (Mavros Unit)	Verne White 1	V. & M. White 2	V. & M. White 3
OPERATOR	Betz Oil, Inc.	Cayman Corp.	Worldwide Pet. Corp.	V. H. Simmons, Jr.	Cayman Corp.	Robert Thorsen	Ventura Oil Co.	Ventura Oil Co.	Ventura Oil Co.	Ventura Oil Co.
TOWNSHIP	Springfield	Springfield	Conneaut	Springfield	Springfield	Springfield	Conneaut	Conneaut	Conneaut	Conneaut
QUADRANGLE	Girard 188	Girard 244	Girard 189	Girard 191	Girard 227	Girard 203	Girard 193	Girard 194	Girard 200	Girard 201
LATITUDE	950 ft. N 41° 55'	12,900 ft. S 42° 00'	14,400 ft. S 41° 55'	2400 ft. N 41° 55'	17,600 ft. S 42° 00'	1200 ft. N 41° 55'	3350 ft. S 41° 55'	2500 ft. S 41° 55'	4500 ft. S 41° 55'	4450 ft. S 41° 55'
LONGITUOE	10,700 ft. W 80° 25'	6800 ft. E 80° 25'	12,650 ft. W 80° 25'	12,300 ft. W 80° 25'	7500 ft. W 80° 25'	5500 ft. E 80° 30'	5200 ft. E 80° 30'	10,800 ft. W 80° 25'	12,600 ft. W 80° 25'	10,800 ft. W 80° 25'
DATE COMPLETEO	3-15-65	12-17-65	3-1-65	4-23-65	9-30-65	6-23-65	4-15-65	4-5-65	5-26-65	6-1-65
ELEVATION	878 G	758 KB	965 G	875 G	710 O	852 G	900 G	883 DF	921 KB	921 KB
TULLY	1608-	1457-					1655-	1637-		
ONONOAGA	1768-	1640-	1938-	17467-	1666-	18107-	1810-	1799-	1852-	1852-
ORISKANY		1930-1945	SW at 2160		18607-1876	SW at 2110	2102-2112	2082-2102	SW at 2058	SW at 2145
SALINA		2020-			1952-		2191-	2176-		
GUELPH - LOCKPORT Block Water		2470-	-2965		2469-		2719-	2714-		
CLINTON IRONOEQUOIT	2996-	2727- 2780-2790	3149?-	2968-	2718- 2770-2782	2940?-	2955- 3022-3033	2953- 3020-3031	3064-	3068-
MEDINA		2807-			2804-		3053-	3050-	3092-	
QUEENSTON		2974-			29647-			3220-		
MIOOLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	3125	2985	3358	3178	2973	3125	3219? 3246?	3246	3243	3267
DEEPEST FORMATION REACHEO	Medina	Queenston	Queenston	Queenston	Queenston	Medina	Medina? Queenston?	Queenston	Medina	Queenston?
RESULT	1300 Mcf gas AF RP 1085 psi. 12 hrs.	1750 Mcf gas AF RP 993 psi. 96 hrs.	8000 Mcf? gas AF RP 1050 psi. 24 hrs.	1330 Mcf gas AF RP 1050 psi. 12 hrs.	500 Mcf gas AF RP 600 psi. 24 hrs.	2059 Mcf gas AF RP 1050 psi. 12 hrs.	3309 Mcf gas AF RP 1085 psi. 24 hrs.	3960 Mcf gas AF RP 1085 psi. 12 hrs.	6680 Mcf gas AF RP 1085 psi.	7138 Mcf gas AF RP 1085 psi.

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	91	92	93	94	95	96	97	98	99	100
COUNTY Permit Number	ERIE 181	ERIE 139	ERIE 159	FAYETTE 51	FULTON 1	FULTON 2	FULTON 3	INDIANA 650	JEFFERSON 348P	JEFFERSON 404
NAME OF WELL	C. Wickersham 1	W. L. Wood 1	Blaine Oennee 1	J. E. Leonard 1	Elmer Hill 1	T. E. Nesbitt 1	C. E. Flinn 1	Leon H. Hoffman 1	R. & P Coal Co. 1	Orover Haag 2
OPERATOR	Cayman Corp.	Worldwide Pet. Corp.	Consol. Gas Supply Corp.#988	Snee & Eberly, Peoples Nat. Gas Co.	Sun Oil Co.	Consolidated Gas Supply Corp.	M. L. & H. Co. #4832	Consolidated Gas Supply Corp.	NYSNG Corp. N-974	T. W. Phillips Gas & Oil Co.
TOWNSHIP	Springfield	Conneaut	Venango	Stewart	Brush Creek	Ayr	Union	N. Mahoning	McCalmont	Young
QUADRANGLE	Girard 236	Girard 168	North East 30	Uniontown 41	Needmore 1	Needmore 2	PawPaw 5	Smicksburg 3	Dubois 40	Punxsutawney 46
LATITUDE	10,950 ft. S 42° 00'	17,600 ft. S 41° 55'	6700 ft. N 42° 00'	9600 ft. S 39° 55'	2950 ft. S 39° 50'	9000 ft. S 39° 55'	8800 ft. S 39° 45'	15,400 ft. S 40° 55'	11,900 ft. N 41° 00'	10,700 ft. S 41° 00'
LONGITUDE	400 ft. E 80° 25'	13,400 ft. W 80° 25'	7200 ft. E 79° 55'	8700 ft. E 79° 35'	2300 ft. E 78° 15'	2200 ft. W 78° 00'	1500 ft. W 78° 20'	1300 ft. E 79° 05'	1800 ft. E 78° 55'	3800 ft. E 79° 00'
DATE COMPLETED	10-25-65	1-15-65	10-8-65	1-2-65	8-13-65	11-5-65	10-6-65	6-4-65	3-19-65	12-19-65
ELEVATION	725 G	958 DF	1463 G	2288 KB	1078 DF	923 O	838 KB	1468 DF	1475 OF	1411 KB
TULLY	1360-		2300-	7053-7130	7450-7468? Clearville 7634-		Clearville 1) 4810- 2) 5062-	6750-6892	6385-6498	6597-6730
ONONDAGA	1540-	1950-		7580- 7600-	9690-		Oolitic 1) 5285 2) 5700	7350- 7364-	6933- 6950-	7174- 7189-
ORISKANY	1830-1860		SW at 2775	7750-	9763- SW @ 9895, 9906		Purcell 6970-	7452- Shriver 7478-	7028- Shriver 7041-	7268-
SALINA	1931-			Keyser, 7856?-			Onondaga not reached			
GUELPH - LOCKPORT Black Water	2438-	2884-								
CLINTON IRONDEQUOIT	2682- 2738-2749	3100- 3190-3202								
MEDINA	2767-	3216-	3715?- 267 Mcf @ 3774							
QUEENSTON	2932-		3886?-							
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG			Precambrian 7430?							
TOTAL DEPTH	2963	3383	7465	7920	9922	8648	7313	7512	7137	7285
DEEPEST FORMATION REACHED	Queenston	Medina	Precambrian	Keyser	Oriskany	?	Hamilton	Shriver	Helderberg?	Oriskany
RESULT	1891 Mcf gas AF RP 905 psi.	2500 Mcf gas AF RP 1050 psi. 12 hrs.	PB to 3850 1061 Mcf gas AF RP 630 psi. 72 hrs.	3148 Mcf gas AF RP 3427 psi. 5 days	Oolitic 7805- 7810 Purcell 9346- 9445 Abandoned	No information released	Well faulted Abandoned	2 bbls SW per hr. at 7454 PB to 3643 for shallow well	PB to 5670 for shallow well	13,385 Mcf gas natural RP 3850 psi. 24 hrs.

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	101	102	103	104	105	106	107	108	109	110
COUNTY / Permit Number	JEFFERSON 371	JEFFERSON 380	JEFFERSON 399	JEFFERSON 377	JEFFERSON 386	LAWRENCE 8	MERCER 36	MERCER 37	MERCER 35	POTTER 193
NAME OF WELL	R & P Coal Co. 2	R & P Coal Co. 3	R & P Coal Co. 4	R & P Coal Co. 5	R & P Coal Co. 6	E. C. Rhodes 1	R. W. Temple 1	Chadderton Services, Inc. 1	S. & A Laudo 1	Pa. State Forest
OPERATOR	Consolidated Gas Supply Corp.	Consolidated Gas Supply Corp.	Consolidated Gas Supply Corp.	T.W. Phillips Gas & Oil Co.	T.W. Phillips Gas & Oil Co.	Peoples Nat. Gas Co.	Peoples Nat. Gas Co. Snee & Eberly	Wm.C. Vendenberg, Jr.	Wm.C. Vandenberg, Jr.	United Nat. Gas Co. Wh 53
TOWNSHIP	Young	Bell	Young	Young	McCalmont	Slippery Rock	Lake	Shenango	Hickory	Wharton
QUADRANGLE	Punxsutawney 41	Punxsutawney 42	Punxsutawney 45	Punxsutawney 43	Punsutawney 44	Zelienople 9	Stoneboro 8	Youngstown 8	Youngstown 7	Conrad 37
LATITUDE	5000 ft. S 41° 00'	2350 ft. S 41° 00'	12,200 ft. S 41° 00'	6500 ft. S 41° 00'	1150 ft. S 41° 00'	8800 ft. S 41° 00'	6700 ft. N 41° 20'	4100 ft. N 41° 10'	8400 ft. N 41° 10'	3500 ft. N 41° 30'
LONGITUDE	9350 ft. E 79° 00'	10,100 ft. W 78° 55'	2700 ft. E 79° 00'	7900 ft. E 79° 00'	10,000 ft. W 78° 55'	4650 ft. W 80° 10'	2650 ft. W 80° 10'	4700 ft. W 80° 30'	1200 ft. W 80° 30'	6000 ft. E 78° 00'
DATE COMPLETED	6-20-65	8-5-65	11-23-65	7-30-65	8-30-65	4-7-65	6-13-65	10-20-65	5-1-65	11-29-65
ELEVATION	1364 DF	1463 DF	1431 DF	1432 DF	1629 DF	1153 KB	1344 KB	1033 KB	835	2006 KB
TULLY	6510-6640	6670-6795	6561-	6625-6760	6950-7015	4352-	3685-	Absent	Absent	5464-
ONONDAGA LIMESTONE	7081-	7230-	7132-	7200-	7455-	4533-	3863-	3397-	3205-	6166-
ONONDAGA CHERT	7094-	7244-	7148-	7222-	7482-					
ORISKANY	7170- Shriver 7193?-	7328- Shriver 7351?-	7235- Shriver 7256?-	7290-	7545- gas at 7549	4688- Shriver? 4707-	4011-		3400- Shriver 3414-	6186-
HELOERBERG						4822?-			3472-	6225-
SALINA							Salt at 4405		3590-	
GUELPH-LOCKPORT									4450?-	
CLINTON							Irondequoit 5400-		4750- Irondequoit 4810-4815	
MEDINA									4890-	
QUEENSTON							5600-			
TOTAL DEPTH	7198	7371	7276	7302	7556	4850	9919	5303	5013	6250
DEEPEST FORMATION REACHED	Shriver?	Shriver?	Shriver?	Oriskany	Oriskeny	Helderberg	Precembrian	Queenston?	Medina	Helderberg
RESULT	2214 Mcf gas natural RP 3960 psi. 199 hrs. Discovery well Elk Run Pool	2296 Mcf gas natural RP 3953 psi. 124 hrs.	3499 Mcf gas natural RP 3865 psi. 24 hrs.	5900 Mcf gas natural RP 4200 psi. 8½ hrs.	1770 Mcf gas natural RP 3900 psi. 48 hrs.	105 Mcf gas AF RP 600 psi. 7 hrs. Abandoned	Unconformity 8500± SO, SW at 8512 Precembrian 9811- Abandoned	Not reported	1200 Mcf gas AF RP 1235 psi.	Drilled for gas storage

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	111	112	113	114	115	116	117	118	119	120
COUNTY / Permit Number	POTTER 194	POTTER 1790	POTTER 195	POTTER 196	SOMERSET 329	TIOGA 369	WARREN 955	WAYNE 4	WESTMORELAND 422	WESTMORELAND 438
NAME OF WELL	Pa. State Forest	Baird Tuller 7	Pa. State Forest	Pa. State Forest 1	John W. Swift 1	F. Cobb, et al "A"-1	Mead 30	Hudson RealtyCorp. 1	George J. Sloan 1	Duquesne Gas Co. 1
OPERATOR	United Nat. Gas Co. Wh 54	Chet Wharton	United Nat. Gas Co. Wh 55	United Nat. Gas Co. Wh 56	Shell Oil Co.	City Service Oil Co.	Pennzoil Co.	Humble Oil & Refining Co.	Peoples Nat. Gas Co., Pgh Plate Glass Co.	Fox, Coen &Sloan
TOWNSHIP	Wharton	Hebron	Wharton	Wharton	Brothers Valley	Delmar	Mead	Clinton	Washington	Franklin
QUADRANGLE	Conrad 38	Coudersport 68	Driftwood 112	Driftwood 113	Meyersdale 4	Antrim 15	Warren 13	Honesdale 2	Freeport 1	Greensburg 5
LATITUDE	300 ft. N 41° 30'	11,900 ft. N 41° 50'	1000 ft. S 41° 30'	2500 ft. S 41° 30'	17,840 ft. S 40° 00'	8500 ft. N 41° 40'	700 ft. N 41° 50'	1600 ft. S 41° 40'	8900 ft. N 40° 30'	300 ft. S 40° 25'
LONGITUDE	1400 ft. E 78° 00'	1200 ft. E 78° 05'	1100 ft. W 78° 00'	600 ft. W 78° 00'	12,950 ft. W 79° 00'	6100 ft. E 77° 20'	8800 ft. W 79° 00'	9000 ft. W 75° 25'	1600 ft. W 79° 35'	9200 ft. W 79° 40'
DATE COMPLETED	12-15-65	2-15-65	11-29-65	12-22-65	6-11-65	7-23-65	10-13-65	4-26-65	3-1-65	8-2-65
ELEVATION	2002 KB	2294 DF	2117 KB	2010 KB	2498 KB	1678 KB	1976 KB	1790 DF	1208 G	1276 DF
TULLY	5410-	5130-	5515-	5441-	7752-	4372-	4294-		6620-6760	6949-7070
ONONDAGA LIMESTONE	6113-	5710-	6214-	6135-	8718-	5366-	4568-		7088-	7472-
ONONDAGA CHERT					8740-				7100-	7485-
ORISKANY	6129-	5742-	6234-	6150-	8837-	5385-	4620-		7252-	7701- Shriver 7726?-
HELDERBERG	6163-		6264-	6181-		5424-	4631?-			
SALINA										
GUELPH-LOCKPORT										
CLINTON										
MEDINA										
QUEENSTON										
TOTAL DEPTH	6202	5755	6303	6219	8958	5480	4718	7443	7310	7800
DEEPEST FORMATION REACHED	Helderberg	Oriskany	Helderberg	Helderberg	Oriskany	Helderberg	Helderberg	Upper Devonian	Oriskany	Helderberg
RESULT	Drilled for gas storage	Old well drilled deeper, Orig. TD 2063, 10 gals. SW at 5748 Abandoned	Drilled for gas storage	Drilled for gas storage	51 Mcf gas BF 46 bbls/hr SW AF Abandoned	60 Mcf gas AF Abandoned	Abandoned	Catskill 3500- Abandoned	Salt Water AF Abandoned	1200 Mcf gas AF RP 3832 psi. 24 hrs. Discovery Well Duquesne Pool

Table 10. *Summarized records of deep wells, Continued*

MAP NUMBER	121	122	123							
COUNTY Permit Number	WESTMORELAND 421	WESTMORELAND 437	WESTMORELAND 448							
NAME OF WELL	J. S. Blair 4	H. A. Byers 1	H. E. Shaulis 1							
OPERATOR	The Peoples Nat. Gas Co.	James Drilling Co.	The Peoples Nat. Gas Co.							
TOWNSHIP	Cook	Cook	Donegal							
QUADRANGLE	Somerset 28	Somerset 29	Somerset 30							
LATITUDE	10,500 ft. N 40° 05'	15,600 ft. S 40° 10'	4200 ft. N 40° 15'							
LONGITUDE	4400 ft. E 79° 15'	6700 ft. E 79° 15'	1300 ft. E 79° 15'							
DATE COMPLETED	3-10-65	7-12-65	12-28-65							
ELEVATION	2929 KB	2715 KB	2845 KB							
TULLY	7530-		7373-							
ONONDAGA LIMESTONE	8181-	8138-	8076-							
ONONDAGA CHERT	8208-	8160-	8104-							
ORISKANY	8340-	8309-	8341-							
HELDERBERG										
SALINA										
GUELPH-LOCKPORT										
CLINTON										
MEDINA										
QUEENSTON										
TOTAL DEPTH	8442	8343	8375							
DEEPEST FORMATION REACHED	Oriskany	Oriskany	Oriskany							
RESULT	11,000 Mcf gas AF RP 2722 psi. 24 hrs. Discovery Well Tunnel Pool	SG & SW AF at 8323 Abandoned	198 Mcf gas and SW AF RP 2400 psi. 24 hrs. Abandoned							